April 29, 2014

EXECUTIVE SUMMARY OF THE PEBBLE LIMITED PARTNERSHIP'S RESPONSE TO EPA'S FEBRUARY 28, 2014 LETTER INITIATING THE CLEAN WATER ACT SECTION 404(C) PROCESS FOR THE PEBBLE MINE PROJECT

In disregard of the rule of law, established precedent, and long respected public policy, the U.S. Environmental Protection Agency ("EPA" or "Agency") has contrived to preemptively block the filing of permit applications for developing the largest and most valuable undeveloped supply of copper and gold in North America, a resource that could be critically important to the U.S. economy and employment in Alaska. Rather than allowing the filing of a mining permit application, EPA employees secretly plotted with environmental activists to undermine the ability of land owners to objectively evaluate and develop the proposed mining of the Pebble deposit in Southwest Alaska ("Pebble Project"), thereby establishing a precedent that will have long-term harmful impacts on investment and job creation in the United States.

This activity involved the misuse of U.S. government funds to create a flawed, junk science laden report, called the Bristol Bay Assessment, designed to negatively influence government, financial markets, and public policy. EPA launched its formal legal attack on February 28, 2014,[1] after years of stacking the deck against the Pebble Project; the attached document is the Pebble Limited Partnership's ("PLP's") response to EPA's latest effort to prejudice the project.

For the reasons set out in PLP's attached response, EPA should immediately rescind its letter stating that the Agency will proceed under Section 404(c) of the Clean Water Act ("CWA") to determine whether it will issue a veto for, or place conditions on, the Pebble Project prior to the submission of a CWA permit application to the U.S. Army Corps of Engineers ("Corps"). The Agency should wait until a permit application has been submitted and the Corps completes its permit application review as prescribed by U.S. environmental law and long-standing precedent.

EPA is reaching far beyond its statutory authority to begin the Section 404(c) veto process based solely upon speculation about the size of the project or the aquatic resources that may be impacted. The relevant statutes make clear that the Agency must wait until a permit application is submitted and the Corps review thereof is completed.

EPA has invited the PLP to provide information "to demonstrate that no unacceptable adverse effects to aquatic resources would result from discharges associated with mining the Pebble deposit . . . ."[2] However, it is fundamentally unfair and improper for EPA to place this

[1] Letter from Dennis J. McLerran, Regional Administrator, Region 10, EPA to Thomas Collier, Joe Balash and Col. Christopher D. Lestochi (Feb. 28, 2014) ("Feb. 28, 2014 EPA Letter").
[2] *Id.* at 2.

burden on PLP before a mine proposal has been fully designed, engineered and proposed to the Corps, particularly since EPA did not quantify any harm to the fisheries in its *Assessment of Potential Impacts on Salmon Ecosystems of Bristol Bay, Alaska* ("Assessment").[3] A comprehensive, science-based analysis of potential effects to aquatic resources can only be achieved during the rigorous, exhaustive CWA permit review and associated National Environmental Policy Act ("NEPA") review process to be undertaken by the Corps, in conjunction with the State of Alaska.

Section 404(c) Does Not Authorize EPA to Veto the Pebble Project Preemptively

Congress has intentionally restricted EPA's authority to veto permits for specified disposal sites based on a permit application under Section 404(c) of the CWA. The Supreme Court has similarly interpreted the CWA to give EPA authority to veto a Corps permit only "for a particular disposal site."[4] In defiance of congressional intent and the Supreme Court's interpretation, EPA is now asserting that the Agency can broadly veto any development within a large region before a Section 404 permit application has even been filed. The Agency's own internal documents weigh the pros and cons of taking "proactive" action under Section 404(c) prior to submission of the Pebble Project application. EPA is attempting to usurp the Corps' permit review authority and to relegate the Corps to a secondary role as a "consulting" agency.

Internal EPA documents also demonstrate EPA's intention to go beyond its statutory authority and to use a preemptive Section 404(c) veto as a mechanism for proactive zoning of watersheds.[5] EPA noted that there would be a "[l]itigation risk," that a preemptive veto had "[n]ever been done before in the history of the CWA," and that the preemptive veto "would result in "[i]mmediate political backlash."[6] Yet Section 404(c) does not authorize EPA to make broad land use or watershed decisions. EPA's authority under Section 404(c) is narrowly prescribed: EPA may veto a specific disposal site only if it can demonstrate unacceptable adverse effects to aquatic resources based on a specific permit. Indeed, EPA's preemptive initiation of the Section 404(c) process prior to the submission of a Section 404 permitting application is unprecedented. The economic harm to Alaskan citizens, companies and the expenditure of taxpayer money to fund this detour from the proper regulatory process can never be fully recovered.

It is always unlawful for an agency to revise legislative and judicial mandates. Such action is particularly inexcusable here, where the motivations for those revisions is simply to circumvent inconvenient impediments to the transient goals of a particular administration.

EPA Must Wait for the Corps' CWA and NEPA Review of a Permit Application

EPA's pre-emptive veto tactic is designed to freeze out the Corps, a co-responsible U.S. executive agency, charged by law with evaluating projects such as Pebble. EPA seems to fear that the Corps will come out the wrong way or look at the project too slowly or too competently.

[3] EPA910-R-14-001A-C (Jan. 2014).
[4] *Coeur Alaska v. Se. Alaska Conservation Council*, 129 S.Ct. 2458, 2467 (2009).
[5] EPA, Bristol Bay 404(c) Discussion Matrix, HQ Briefing, at 1 (Sept. 8, 2010).
[6] *Id.*

Regardless of the reason, it cannot be countenanced. EPA should wait for the Corps' review of a permit application and associated NEPA review before deciding whether to initiate the Section 404(c) veto process for the Pebble Project. For decades, the Agency has waited for the Corps' review and NEPA review before initiating the Section 404(c) process and there is no credible excuse for not doing so here. The Corps' Section 404 review process, and the associated NEPA review, will provide a full record on the scope and potential impacts of the project, including project- and site-specific mitigation, with opportunities for EPA and public input.

Initiating the preemptive veto process would undermine the role and authority Congress assigned to the Corps under the CWA. The Corps must undertake a rigorous review of the permit application under CWA 404. Both the Corps' CWA permit review and the Environmental Impact Statement ("EIS") will provide robust data and analysis of the environmental impacts based on the details set forth in the application, as well as vital stakeholder and public input. The application itself will contain extensive information on the scope of the project, including detailed data on construction and operation plans, and potential impacts. Moreover, the Corps cannot issue a permit or license for an activity that may result in a discharge to waters of the United States until the state or tribe where the discharge would originate has granted or waived certification. Respect for the rights of the states and localities involved has been an historic hallmark of the permitting process, ignored here.

As EPA has admitted, the NEPA process would be more comprehensive and would address considerations beyond the scope of EPA's Assessment. An EIS would include a careful, thorough and systematic review of all of the impacts of the project, as proposed by the applicant, as well as reasonable alternatives and a full complement of project- and site-specific mitigation measures. The public, the Corps, EPA, tribes and the state would all be able to participate in developing the scope and content of the EIS. The state, tribes and local communities with a stake in the economics of the area could provide needed input concerning the economic and social impacts of the Pebble Project, including the salutary economic impact of expanded employment opportunities and augmentation of social services afforded by the presence of this project. The NEPA process could yield mitigation measures or alternatives that answer many of the concerns EPA has raised.

In the past, EPA only exercised its Section 404(c) authority rarely and as a last resort, after it reviewed a proposed Corps permit decision, provided any objections or comments through the NEPA process, and given the Corps and applicant an opportunity to address EPA's concerns through amended project design and/or project- and site-specific mitigation. In the 13 out of 14 times that EPA commenced the Section 404(c) process, a permit application had already been filed for a specific area for specific materials. In the sole application where a permit application had not been submitted for a specific site, EPA determined that the application to be filed would be substantially similar to two prior applications for neighboring sites.

EPA should continue its precedent in this case, as to act preemptively without a specific proposed project or full CWA and NEPA record would be legally unsupportable. These established procedures are the best means to achieve EPA's goal of assuring certainty to affected parties. Moreover, EPA scientists have admitted that the NEPA permitting process would be

more rigorous, comprehensive, and better suited to regulatory decision-making than the Assessment.[7] Abandoning the NEPA process – particularly when there could be no environmental harm in letting the process unfold – is counter-productive and inconsistent with EPA precedent.

EPA's Bristol Bay Assessment Does Not Provide a Legitimate Basis for Initiating Section 404(c) Action

EPA insists in its February 28, 2014 letter that its decision to proceed under Section 404(c) is based in large part on EPA's Assessment. But EPA's Assessment does not provide a legitimate basis for determining that the Pebble Project will cause an unacceptable adverse effect under Section 404(c) for several reasons:

- The Assessment evaluates mine scenarios of EPA's creation, which do not reflect modern mine engineering and environmental management practices. The Assessment's failure to consider modern mining and engineering practices led to numerous flaws in the Assessment, including:
    - Projected impacts on downstream water quality, water flows and aquatic habitat are greatly exaggerated.
    - Risks associated with tailings storage and other project features and operations are significantly overstated.
- PLP has not yet defined a proposed development plan for the Pebble Project; accordingly, development footprints and footprint impacts associated with the Assessment's mine scenarios are speculative. Speculation cannot form the basis for regulatory action under Section 404(c).
- The Assessment does not account for the robust compensatory mitigation measures (related to both aquatic habitat and wetlands) required of such a project.
- While the Assessment predicts certain impacts of mineral development on aquatic habitat, it provides no causal link between these effects and "unacceptable adverse effects" on any Bristol Bay fishery. For this reason, EPA has not demonstrated that mineral development will cause unacceptable adverse impacts on fishery areas in the Bristol Bay watershed.

Estimates of potential aquatic habitat impacts associated with stream flow changes resulting from EPA's three mine scenarios provide a good example of why the Assessment represents an insufficient scientific foundation for regulatory decision making. This is the case for a number of reasons:

[7] *See, e.g.*, Response to Peer Review Comments, at 82 ("The assessment is sufficiently comprehensive to meet its stated purpose. It is not intended to be an environmental impact assessment."); *id.* at 165 ("The assessment is not intended to duplicate or replace a regulatory process . . ."); *id.* at 217 ("[D]etailed evaluation of those effects will be left to the NEPA and permitting processes should a mine be proposed.").

- EPA has proposed an arbitrary surplus water release strategy for its three mine scenarios that would deny one of the streams surrounding the proposed Pebble Project (Upper Talarik Creek) from receiving any restorative flows to mitigate downstream habitat effects.

- EPA has wrongly and unfairly attributed its arbitrary surplus water release strategy to Northern Dynasty Minerals Ltd., owner of the Pebble Project. This attribution is entirely false.

- EPA has selected improper locations for releasing surplus water from its three mine scenarios, unnecessarily leaving miles of aquatic habitat in another stream surrounding the proposed Pebble Project (South Fork Koktuli) with no restorative flows.

- EPA has underestimated surplus water available for treatment and release by some 80%, leading to substantially larger flow-habitat effects than would actually occur.

- EPA has utilized an unsophisticated "rule of thumb" approach to measuring downstream habitat effects associated with stream flow changes, rather than using the sophisticated habitat modeling undertaken by PLP, which will provide the basis for a science-based impact assessment under NEPA.

A proper science-based surplus water release strategy, employing more rigorously devised hydrology estimates and sophisticated modelling of stream flow-habitat relationships, would demonstrate how to achieve net spawning and rearing habitat gains for the vast majority of anadromous and resident fish species. This singular example demonstrates the serious methodological and scientific flaws underlying the Assessment, and why EPA must await the submission of a proposed development plan for the Pebble Project and completion of a comprehensive EIS under NEPA before undertaking any regulatory action under Section 404(c).

The EPA Assessment itself is a biased document with a pre-determined outcome, as demonstrated by EPA's actions and procedures prior to initiating the Assessment, and during its development.

First, before the Assessment process even began, personnel in EPA's Region 10 were requesting funds to initiate a veto.[8] According to the request, "While resorting to exercising EPA's 404(c) authority is rare (only 12 actions since 1981), the Bristol Bay case represents a clear and important need to do so given the nature and extent of the adverse impacts coupled with the immense quality and vulnerability of the fisheries resource."[9] EPA personnel worked closely with mine opponents and lobbied other agencies to support a veto. One EPA ecologist wrote about the "catastrophic failure" certain to result from the mine,[10] and wrote in an email to a

[8] U.S. EPA, FY11 Proposed Investment: Bristol Bay 404(c).
[9] *Id.*
[10] Letter from Richard E. Schwartz, Attorney for Northern Dynasty Minerals Ltd. to Arthur A. Elkins, Jr. Inspector General, EPA, at 2-4 (Mar. 19, 2014).

mine opponent, "We have been discussing 404(c) quite a bit internally at all levels of EPA. This letter will certainly stoke the fire. I look forward to talking to you in the near future."[11] After finding traction in EPA and among mine opponents, that EPA ecologist took his advocacy to other federal agencies, enlisting the support of the U.S. Fish and Wildlife Service. The collaboration seemed to make a veto a foregone conclusion; one USFWS internal memorandum dated October 1, 2010 was titled, "EPA to Seek Service Support *When* They Use Section 404(c) of the Clean Water Act."[12] The Assessment was merely a tool to support EPA's predetermined goal: to preemptively kill the Pebble Project. As a result of EPA's clear bias, the Assessment's conclusions, as well as its ability to serve as a foundation for a major regulatory decision, are unreliable.

Second, the peer review process casts significant doubt on the ultimate quality, utility, and scientific integrity of the Assessment. For the 2012 and 2013 draft Assessments, EPA manipulated the process and short-circuited traditional review procedures to minimize criticism. Peer review of reports authored by mine opponents upon which EPA heavily relied for its draft Assessment found several significant flaws in the reports' methodologies and the data that EPA incorporated into the Assessment. The peer review comments make clear that the Assessment should not be relied upon to support a major regulatory decision such as a Section 404(c) veto. EPA scientists apparently agree, as they repeatedly stated that the Assessment is "not a decision document" in response to the peer review and public comments.[13]

In sum, not only is the Assessment based on speculative mine scenarios that do not reflect international best practices or even, in some instances, conventional mining practices, it is also based on data and analyses that are both less exhaustive and of lower overall quality than would be undertaken as part of an EIS process under NEPA. Indeed, EPA scientists' own characterizations undermine any attempt to use the Assessment as a basis of a Section 404(c) veto of the Pebble Project. To take any action under Section 404(c), EPA must have a record clearly establishing an unacceptable adverse effect on municipal water supplies, shellfish beds and fishery areas (including spawning and breeding areas), wildlife, or recreational areas." The Assessment does quantify any impact on any regional fishery – commercial, subsistence or sport – and as such, cannot be that record.

A Section 404(c) Veto Would Violate the Alaska Statehood Act and ANILCA

EPA's attempt to usurp the Section 404 process before it has even begun demonstrates that this initiation of the Section 404(c) veto process is not about a particular permit, but instead is based on EPA's broader goal of precluding development of the state lands in the Bristol Bay watershed. One internal EPA document even characterized the option of waiting for the permitting process as a disadvantage because "only that project would be prohibited", which did not serve EPA's goal of "proactive watershed planning."[14] These statements indicate that EPA is effectively precluding any development of the state lands, which violates the statutory

[11] *Id.* at 5.
[12] Letter from Richard E. Schwartz, Attorney for Northern Dynasty Minerals Ltd. to Arthur A. Elkins, Jr. Inspector General, EPA, at 8 (Mar. 19, 2014) (emphasis added).
[13] *See, e.g.*, Response to Peer Review Comments, at 35.
[14] EPA, Bristol Bay 404(c) Discussion Matrix, HQ Briefing, at 1 (Sept. 8, 2010).

compromise established in the Alaska Statehood Act and ANILCA. Congress adopted both statutes to balance Alaska's economic interests in its land with environmental conservation efforts. EPA's reach beyond its statutory authority under Section 404(c) of the CWA is a blatant attempt to bypass Congress's explicit intent to prevent the federal government from usurping Alaska's interests.

The Harms of Initiating a Preemptive 404(c) Process Greatly Outweigh EPA's Stated Benefits

EPA cannot find that the Pebble Project will have an "unacceptable adverse effect", and thereby, cannot issue a Section 404(c) veto, because a permit application has not yet been submitted. The February 28, 2014 EPA letter insists that "mining the Pebble deposit will involve excavation of the largest open pit ever constructed in North America, completely destroying an area as large as 18 square kilometers and as deep as 1.24 kilometers." Yet the sponsors of the Pebble Project have not proposed a specific mine project and the area of potential impact cannot be known until the location, scope and scale of the project is determined. It is axiomatic that EPA cannot determine whether the proposed Pebble Project will have an unacceptable adverse effect on aquatic resources without a permit application outlining the project's specific location, size and characteristics.

Preemptive Section 404(c) action is also premature and unnecessary since EPA retains its veto authority after a permit application is submitted and an EIS has been completed. EPA will be able to participate fully in the EIS and CWA review processes well before any mine development activities could proceed. Therefore, no harm to the environment will occur should EPA follow the proper permitting process for this project – waiting for an application, the Corps' review, and an EIS. Moving forward with a preemptive veto, on the other hand, will have far-reaching impacts on this project and the local economy. The Pebble Project would provide a much needed boost to struggling local communities, including employment and tax payments that would provide resources for additional schools, health facilities and other community infrastructure. For EPA to stop this project without a full permit and NEPA review process, including consideration of socioeconomic impacts, would be unsupportable and unforgiveable.

A preemptive veto will also substantially deter investments in other major projects requiring Section 404 permits, potentially resulting in substantial impacts to the U.S. economy. EPA's ability to preemptively veto projects before a permit application is even filed creates significant regulatory uncertainty for all major projects that require Section 404 permits, and will cause developers to distrust the entire Section 404 permitting process. The financial risk of backing a project that requires a Section 404 permit is significantly increased if a possibility exists that a project could be vetoed by EPA even before an applicant has an opportunity to propose a specific project or to demonstrate its ability to meet CWA criteria. The potential harm resulting from decreased domestic and foreign investment is significant: the Corps processes approximately 60,000 CWA 404 permits each year, and, according to some estimates, roughly $220 billion of investment per year depends on these permits.[15] EPA should respect the

[15] *See* David Sunding, *Economic Incentive Effects of EPA's After-the-Fact Veto of a Section 404 Discharge Permit to Arch Coal*, at 1 (May 2011).

permitting process that Congress established. To usurp the Corps' (and State's) role here will only serve to undermine the legitimacy and predictability of the Section 404 permitting process.

THE pebble PARTNERSHIP

April 29, 2014

Via E-Mail
Dennis J. McLerran
Regional Administrator
U.S. Environmental Protection Agency, Region 10
1200 Sixth Avenue, Suite 900
Seattle, WA 98101-3140

Dear Mr. McLerran:

I am writing in response to your letter dated February 28, 2014[1] stating that the U.S. Environmental Protection Agency ("EPA" or "Agency") will proceed under Section 404(c) of the Clean Water Act ("CWA") to determine whether to issue a veto for, or place conditions on, the proposed mining of the Pebble deposit in Southwest Alaska ("Pebble Project") prior to the submission of a permit application to the U.S. Army Corps of Engineers ("Corps").

Overview

This Response covers the following main points:

[1] *See* Letter from Dennis J. McLerran, Regional Administrator, Region 10, EPA to Thomas Collier, Joe Balash and Col. Christopher D. Lestochi (Feb. 28, 2014) [hereinafter Feb 28, 2014 EPA Letter].

Introduction

EPA is acting beyond its legal authority and should immediately rescind its letter and revert to the time-tested administrative process under Section 404. Congress only granted EPA limited authority to veto permits for specified disposal sites under Section 404(c), not to broadly veto any development within a large region prior to the submission of an application. This restricted authority was by Congressional design. Until a permit application is filed, and the Corps' permit review is completed, there is insufficient information on which to base a Section 404(c) decision.

Initiating a preemptive veto process will short-circuit the important regulatory and public review steps included in the CWA 404 permit process, including the Corps' alternatives analysis, the State (of Alaska) Section 401 water quality certification, and the National Environmental Policy Act ("NEPA") review process.

By proceeding as proposed, the Section 404(c) process must necessarily be based on EPA's *Assessment of Potential Impacts on Salmon Ecosystems of Bristol Bay, Alaska* ("Assessment"),[2] which does not provide a legitimate basis for making a regulatory decision on the Pebble Project. By EPA's own admission, the Assessment was never intended as a decision document for a regulatory decision, in part because it assesses only speculative mine development scenarios rather than an actual permit proposal.[3] Moreover, the flaws pointed out in the peer review process and stakeholder review submissions demonstrate that the Assessment is of questionable scientific value. Rather than attempting to act preemptively based on this flawed record, EPA should await a permit application and an Environmental Impact Statement ("EIS") under NEPA. Allowing this statutory process to proceed as intended poses no risk of environmental harm, since mine construction could not proceed without a Corps permit.

Acting preemptively without a specific proposal also indicates that this veto process is not about a particular permit or project, but instead is based on a broader goal of precluding any development that could impact the Bristol Bay watershed. By acting preemptively rather than waiting for a specific application, EPA is effectively precluding any development within a large swath of state land, which violates the statutory compromise established in the Alaska Statehood Act and the Alaska National Interest Lands Conservation Act ("ANILCA"). Congress adopted both statutes to balance Alaska's economic interests in its land with environmental conservation efforts. EPA cannot use its authority under Section 404(c) of the CWA to undermine Congress's explicit intent to protect Alaska's interests in its state lands.

These legal infirmities can be avoided if EPA follows its past precedent and established procedures and allows the sponsors of the Pebble Project to submit a Section 404 permit application and the Corps to review the application, including under NEPA's EIS process, before determining whether Section 404(c) will be triggered for the Pebble Project.

---

[2] *See* EPA, *Assessment of Potential Impacts on Salmon Ecosystems of Bristol Bay, Alaska*, EPA 910-R-14-001A-C (Jan. 2014) [hereinafter *Assessment*].

[3] *Assessment* at 35 ("[T]his assessment is based on available data and is intended as a background scientific document rather than a decision document.").

Finally, we note that your February 28th letter invites the Pebble Limited Partnership ("PLP") to provide information "to demonstrate that no unacceptable adverse effects to aquatic resources would result from discharges associated with mining the Pebble deposit . . . ."[4] However, it is inappropriate for EPA to attempt to place this burden on PLP before a mine proposal has been fully designed, engineered and proposed to the Corps. An analysis of the potential impacts of the Project can only be achieved after the rigorous, exhaustive CWA permit review and associated NEPA EIS process to be undertaken by the Corps, in conjunction with the State. To expect a proponent to do so in the absence of a proposed development plan (including detailed engineering design and project and site-specific mitigation) and on an accelerated timeline under EPA's 404(c) process is unreasonable, unlawful, and inappropriate. We believe it is tantamount to denying due process by foreclosing opportunity for science to be objectively presented, reviewed and assessed.

Discussion

I. Section 404(c) Does Not Authorize EPA to Take Preemptive Action Against the Pebble Project

A. Congress Only Authorized EPA to Veto or Restrict Specific Permit Proposals

Under Section 404 of the CWA, Congress has delegated to the Corps authorization to "issue permits, after notice and opportunity for public hearings for the discharge of dredged or fill material into the navigable waters at *specified* disposal sites."[5] EPA, on the other hand, was delegated a much narrower window of authority under Section 404(c). As the D.C. Circuit explained, Section 404(c) "affords EPA two distinct (if overlapping) powers to veto the Corps' specification: EPA may (1) 'prohibit the *specification* (including the withdrawal of *specification*) of any *defined area* as a disposal site' or (2) 'deny or restrict the use of any *defined area* for *specification* (including the withdrawal of the *specification*).'"[6] And EPA may take such action only after determining "that the discharge of *such materials* into *such area* will have an unacceptable adverse effect on municipal water supplies, shellfish beds and fishery areas (including spawning and breeding areas), wildlife, or recreational areas."[7]

The legislative history of the CWA further illuminates Congress's intent to grant authority to EPA only to veto or restrict specific disposal sites, as set forth in a permit application. Originally, the Senate bill proposing the regulation of dredge or fill activities delegated to EPA complete authority to issue permits, as it does for discharges of other pollutants under the CWA. A subsequent House amendment, however, proposed delegating the permitting authority to the Corps. The House and Senate later agreed to allocate decisions on dredge or fill projects between the Corps and EPA. The Senate Debate on the Conference Report explained that the Committee found that EPA "should have the veto over the *selection of the site for*

[4] Feb 28, 2014 EPA Letter at 2.
[5] 33 U.S.C. § 1344(a) (emphasis added).
[6] *Mingo Logan Coal Co. v. EPA*, 714 F.3d 608, 614 n.2 (D.C. Cir. 2013) (quoting 33 U.S.C. § 1344(c)) (emphasis added).
[7] 33 U.S.C. § 1344(c) (emphasis added).

dredged soil disposal and over any *specific soil* to be disposed of in any *selected site*."[8] Under the enacted bill, EPA's duties to evaluate the permit application would not be duplicative of the Corps' duties "because *the permit application* transmitted to [EPA] for review will set forth *both the site to be used and the content of the matter of the soil to be disposed*. The Conferees expect the Administrator to be expeditious in his determination as to whether a site is acceptable or if specific soil material can be disposed of at such site."[9] The House Debate on the Conference Report similarly provided that "it is expected that disposal site restrictions or prohibitions *shall be limited to narrowly defined areas*".[10]

Thus, Congress only granted EPA authority to prohibit or restrict specified disposal sites under Section 404(c), not to set aside areas of land in advance of any permit application. As the Supreme Court held in *Coeur Alaska Inc. v. Southeast Alaska Conservation Council*, the CWA "gives EPA authority to 'prohibit' *any decision by the Corps* to issue a permit for *a particular disposal site*."[11] Despite this clear statutory delineation of the respective roles of the two agencies, EPA has now asserted authority to act before a permit application has even been filed, thereby usurping the Corps' permit review authority and relegating the Corps to a secondary role as a "consulting" agency.[12]

Lastly, the CWA does not authorize EPA to begin the Section 404(c) veto process based solely upon speculation about the size of the project or the resources that may be impacted. The CWA authorizes EPA to take action under 404(c) only when EPA has demonstrated that a specific project will have "an unacceptable adverse effect."[13] EPA's regulations define an "unacceptable adverse effect" as an "impact on an aquatic or wetland ecosystem which is likely to result in significant degradation of municipal water supplies (including surface or ground water) or significant loss of or damage to fisheries, shellfishing, or wildlife habitat or recreation areas."[14] As discussed more fully below in Section III, EPA has not demonstrated effects of these types because the Agency has been unable to quantify any impacts of its hypothetical mines on any Bristol Bay fishery – commercial, subsistence or sport.[15]

Here, EPA cannot meet its statutory burden of finding that the Pebble Project will have an "unacceptable adverse effect" because a permit application has not yet been submitted. The

---

[8] Senate Consideration of the Report of the Conference Committee, *reprinted in* 1 A Legislative History of the Water Pollution Control Act Amendments of 1972, at 161, 177 (1973) (emphasis added).
[9] *Id.* (emphasis added).
[10] Conference Report—House Debate (Oct. 4, 1972), *reprinted in* 1 A Legislative History of the Water Pollution Control Act Amendments of 1972, at 236 (1973) (emphasis added); *see also* H.R. 11896 (Mar. 27, 1972), in 1A Legislative History of the Water Pollution Control Act Amendments of 1972, at 325 (1973) ("It is expected that until such time as feasible alternatives methods for disposal of dredged or fill material are available, unreasonable restrictions shall not be imposed on dredging activities essential for the maintenance of interstate and foreign commerce.").
[11] 557 U.S. 261, 274 (2009) (emphasis added). *See also Mingo Logan Coal,* 714 F.3d at 614 ("Subsection 404(c) authorizes the Administrator, after consultation with the Corps, to veto *the Corps' disposal site specification*.").
[12] *See* Feb. 28, 2014 EPA Letter at 2.
[13] 33 U.S.C. § 1344(c); *see also James City Cnty., Va. v. EPA*, 758 F. Supp. 348 (E.D. Va. 1990) ("EPA has not met its statutory duty of showing that the discharge necessary for the Ware Creek Reservoir will have an unacceptable adverse effect").
[14] 40 C.F.R. § 231.2(e).
[15] *See infra* Section III. E.

February 28, 2014 EPA letter insists that "mining the Pebble deposit will involve excavation of the largest open pit ever constructed in North America, completely destroying an area as large as 18 square kilometers and as deep as 1.24 kilometers."[16] Yet the sponsors of the Pebble Project have not proposed a specific mine project and the area of potential impact cannot be known until the location, scope and scale of the project is determined. It is axiomatic that EPA cannot determine whether the proposed Pebble Project will have an unacceptable adverse effect on the wetland ecosystem without a permit application outlining the specific location, size and characteristics of the project.

B. EPA Is Seeking to Impermissibly Expand Its Statutory Authority

Despite Congress's clear intention to narrow EPA's authority to review only the environmental effects of a particular permit action, EPA is attempting to usurp the Corps' authority by preemptively initiating the Section 404(c) process. In materials prepared for a briefing of former EPA Administrator Lisa Jackson, EPA staff outlined the advantages of "proactive" action under Section 404(c) prior to the submission of the Pebble Project application.[17] Specifically, the briefing document provides that "[a] proactive 404(c) will provide the regulated community clarity on what can and cannot be permitted allowing for more efficient and timely development of permitted projects."[18] Yet Congress did not delegate to EPA the authority to make that determination prior to the submission of a permit application and the Corps' review of that application. The CWA provides that the Corps, not EPA, "may issue permits . . . for the discharge of dredged or fill material into the navigable waters at specified disposal sites."[19] By preemptively instituting the 404(c) process pre-application, instead of assessing the environmental implications of a specific proposed permit action, EPA would effectively usurp the Corps' authority to review a permit application for a specific site. In the same briefing materials mentioned above, EPA acknowledged that the Agency was pushing the boundaries of its statutory authority, noting that there would be a "[l]itigation risk," that a preemptive veto had "[n]ever been done before in the history of the CWA," and that the preemptive veto "would result in "[i]mmediate political backlash."[20]

The briefing document also discusses using a preemptive Section 404(c) process as a mechanism for zoning watersheds, stating that the preemptive veto "[c]an serve as a model of proactive watershed planning for sustainability."[21] EPA's proactive use of Section 404(c) is an attempt to expand its statutory authority under CWA to land use planning, including of state, tribal, and private lands. However, Section 404(c) is not a broad watershed planning tool; it is very narrowly prescribed – EPA can veto a specific disposal site *only if* it can demonstrate unacceptable adverse effects to aquatic resources. Congress has not authorized EPA to engage in general watershed planning for sustainability. Instead, EPA has been delegated authority merely to determine whether a proposed mine as described in a permit application will have *unacceptable* adverse effects.

---

[16] Feb. 28, 2014 EPA Letter, at 1.
[17] *See* Exhibit A, EPA, Bristol Bay 404(c) Discussion Matrix, HQ Briefing, at 1 (Sept. 8, 2010).
[18] *Id.*
[19] 33 U.S.C. § 1344(a).
[20] *See* Exhibit A, Bristol Bay 404(c) Discussion Matrix at 1.
[21] *Id.*

EPA's impermissible expansion of its authority to regulate zoning of watersheds is even more problematic considering that the State of Alaska has developed a comprehensive land use plan for the Bristol Bay region.[22] Drafted in 1985 and updated in 2005 following extensive public consultation, the Bristol Bay Area Plan for State Lands "determines management intent, land-use designations, and management guidelines that apply to all state lands in the planning area."[23] EPA's attempt to use the 404(c) process for "proactive watershed planning" in the Bristol Bay area will effectively preempt Alaska's plans for its state lands.

EPA's initiation of the Section 404(c) process prior to the submission of a permit application for a specific site within a regional area is unprecedented. EPA's briefing document explains that initiating the 404(c) process before a permit application has been submitted has "[n]ever been done before in the history of the CWA."[24] In the 13 out of 14 times that EPA has previously commenced the Section 404(c) veto process, a permit application *had already been filed* for a specific area for specific materials. In the sole instance where a permit application had not been submitted for a specific site, EPA determined that the application to be filed would be substantially similar to two prior applications for neighboring sites.[25] All three proposed locations were located in the Taylor Slough drainage area in Dade County, Florida.[26] The third site with the pending application was only approximately 312 acres.[27] EPA concluded that because all three locations "are essentially similar pieces of the East Everglades wetlands complex with similar ecological values . . . the initiation of one 404(c) action embracing all three tracts would be an efficient and appropriate way for the Federal government to address the serious environmental concerns."[28] Further, the Corps had indicated that it would grant the permit, so EPA had considerable information on the expected permit application as well as the Corps' likely response thereto before issuing a veto.[29] Here, there are no prior applications or Corps review on which EPA can rely to form a basis for initiating the veto process regarding the Pebble Project. Section 404(c) action is unauthorized here, where specific information from a permit application and Corps review is absent.

II. EPA Should Wait for the Corps' CWA and NEPA Review Prior to Invoking Section 404(c)

Consistent with its past practice under Section 404(c), EPA should wait for the Corps' review of a permit application and associated NEPA review before deciding whether to initiate the Section 404(c) veto process for the Pebble Project. The 404(c) process indisputably

---

[22] *See* Alaska Department of Natural Resources, Bristol Bay Area Plan for State Lands (Apr. 2005), *available at* http://dnr.alaska.gov/mlw/planning/areaplans/bristol/.
[23] *Id.* at 1-1.
[24] *See* Exhibit A, Bristol Bay 404(c) Discussion Matrix at 1.
[25] Proposed 404(c) Determination to Prohibit, Deny, or Restrict the Specification of Use of Three East Everglades Areas as Disposal Sites; Notice and Public Hearing Announcement, 52 Fed. Reg. 38519 (Oct. 16, 1987).
[26] *Id.*
[27] *Id.* at 38520.
[28] *Id.*
[29] EPA, Final Determination of the U.S. Environmental Protection Agency's Assistant Administrator for Water, Concerning Three Wetland Properties (sites owned by Henry Rem Estate, Marion Becker, et. al. and Senior Corporation) for which Rockplowing I Proposed in East Everglades, Dade County, Florida, at 4 (June 15, 1988), *available at* http://water.epa.gov/lawsregs/guidance/wetlands/404c.cfm ("[T]he Corps had predisposed itself to issuing a permit authorizing rockplowing . . . in the supporting documentation for the permit . . .").

contemplates that an application would be submitted and reviewed by the Corps before the veto process would be initiated. The Corps' Section 404 review process, and the associated NEPA review, will provide a full record on the scope and potential impacts of the project, including project- and site-specific mitigation, with opportunities for EPA and public input. Both the Corps' permit review and the EIS will provide robust environmental impacts data and analysis based on the particulars set forth in the application, as well as vital stakeholder and public input. As EPA has admitted, the NEPA process would be more comprehensive and would address considerations beyond the scope of the Assessment. EPA should not attempt to initiate the veto process for this project before this permit-specific record has been developed.

A. EPA Should Not Take Any Action Until a Permit Application Has Been Submitted and Reviewed by the Corps

The Corps' Section 404 Permit Review Process involves a rigorous review of a project, including identifying the least environmentally damaging practicable alternative ("LEDPA"), as well as mitigation measures. To issue a Section 404 permit, the Corps must ensure that the activity complies with the EPA 404(b)(1) Guidelines, set forth in 40 C.F.R. Part 230. The purpose of the Guidelines is "to restore and maintain the chemical, physical, and biological integrity of waters of the United States through the control of discharges of dredged or fill material."[30] A dredge or fill action (1) must not "cause or contribute to significant degradation of the waters of the United States"; (2) must not cause or contribute to a water quality violation; and (3) must be in the public interest.[31] The project applicant is required to prepare a comprehensive 404(b)(1) analysis to provide the Corps with the necessary information to determine whether the Guidelines have been followed. If a project cannot demonstrate compliance with these guidelines, the 404 permit will be denied.

In order to meet this rigorous review, the Pebble Project permit application, when it is completed and filed, will include extensive information on the design and scope of the project, including detailed data on construction and operation plans and potential impacts. The permit application process will begin with pre-application consultations with the Corps, so that the applicant understands the specific information needed to provide a complete application. Based on those consultations, the applicant will develop extensive data to support the application. For example, the permit application will include:

- biological assessments;
- an environmental mitigation plan, including for wetlands and other aquatic resources;
- a cultural resources survey;
- a spill prevention, containment, and countermeasure plan;
- an environmental report and field study;
- a project schedule;
- environmental baseline documents;
- a conceptual draft reclamation/closure plan;

[30] 40 C.F.R. § 230.1(a).
[31] *Id.* § 230.10.

- a list of required permits; and
- an alternatives assessment report.

The application will provide detailed information about each of the Project's proposed locations for fill placement, including delineations of all aquatic features. The application will include a Construction, Mitigation, and Reclamation Plan ("CMRP"), which describes how the applicant would construct the project, restore affected aquatic features, and mitigate adverse impacts.

Once the application is submitted and deemed complete, the Corps is charged with review of the project, including whether "there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem . . . ."[32] "An alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes."[33] This LEDPA review is at the heart of Section 404 permitting, as noncompliance with the LEDPA requirement is a sufficient basis for the Corps to deny the permit. As EPA scientists have admitted, and as discussed more fully below in Section III, the permitting and NEPA processes are considerably more detailed and comprehensive than the contents of the Assessment.[34]

Additionally, the Corps will evaluate if a discharge of fill material is prohibited because it "[c]auses or contributes, after consideration of disposal site dilution and dispersion, to violations of any applicable State water quality standard."[35] Under CWA § 401, the Corps cannot issue a permit or license for an activity that may result in a discharge to waters of the United States until the State or tribe where the discharge would originate has granted or waived Section 401 certification. A Section 401 water quality certification provides states and authorized tribes with an important opportunity to address the aquatic resource impacts of federally issued permits and licenses.[36] Alaska values its regulatory interest in the matter highly. In a recent letter to EPA's Inspector General, the Attorney General noted how Alaska "views with alarm the threat posed by a federal agency that can effectively preempt legitimate and lawful State regulatory authority over proposed activities on State lands.[37]

In sum, the 404(b)(1) Guidelines compliance process is managed by the Corps, but other resources agencies, including the State and tribes, have integral roles in the process. A preemptive veto would undermine the role and authority Congress assigned to these regulatory agencies. EPA should allow the Corps, State, and tribes to undertake the respective review processes assigned to them under the CWA. Moreover, EPA would not be forced to sit on the

---

[32] *Id.* § 230.10(a).
[33] *Id.* § 230.10(a)(2).
[34] *See, e.g.*, EPA, Response to Peer Review Comments, at 221, *available at* http://www2.epa.gov/bristolbay/peer-review-process ("We agree that a more detailed assessment of direct and indirect impacts of mining to wildlife will have to be done as part of the NEPA and permitting processes.").
[35] 40 C.F.R. § 230.10(b)(1).
[36] The § 401 certification is just one aspect of the important role the State of Alaska will play in the permitting process. The state is a co-regulator of mining projects, along with EPA and the Corps, under a variety of federal and state programs, including water quality, fisheries and wildlife, solid waste disposal, air quality permits, cultural resources, and reclamation.
[37] *See* Exhibit B, Letter from Michael C. Geraghty, Attorney General, State of Alaska, to Arthur A. Elkins, Jr., Inspector General, EPA, at 1 (Feb. 3, 2014) [hereinafter Feb. 3 Attorney General Letter] (citing *Solid Waste Agency of N. Cook Cnty. v. U.S. Army Corps of Eng'rs*, 531 U.S. 159, 173-74 (2001).

sidelines until the Corps issued a decision on the permit application, but instead could be involved throughout the 404(b)(1) Guidelines review process. By working with the Corps, State, tribes and applicant through the 404 permit process, EPA may be able to address its concerns with the project without having to preemptively hijack the entire process. Finally, waiting for the NEPA process to develop in no way compromises EPA's statutory veto authority – EPA could still take action before a final permit is issued and any environmental impacts occurred.

B. EPA Should Not Take Any Action Until an EIS Has Been Prepared

In addition to its responsibilities under the CWA, the Corps must also comply with the requirements of NEPA,[38] which requires agencies to "take a hard look" at the potential impacts of a federal action.[39] Thus, pursuant to NEPA, the Corps will prepare an EIS once the permit application is filed. The EIS process will provide valuable information on the potential impacts of the Pebble Project permit proposal, including a comprehensive review of impacts to water quality, wetlands, and other aquatic resources. The EIS will also evaluate potential project- and site-specific mitigation measures, social and economic impacts, and alternatives. Integrated with the NEPA process will be the Endangered Species Act Section 7 consultation process, under which the Corps will consult with the services (FWS and/or NMFS) regarding the project's potential impacts to threatened or endangered species, likely culminating in a biological opinion.[40] All of this information is critical to a full understanding of the potential impacts of the Pebble Project, and goes well beyond the analysis undertaken by EPA as part of its Assessment.

The NEPA process also serves an important procedural role. EPA generally only takes action under Section 404(c) after the NEPA process for the proposed project, if applicable, has concluded.[41] Commenting on the draft and final EIS allows EPA to voice its concerns about the

---

[38] 42 U.S.C. § 4321 *et seq*.
[39] *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989).
[40] 16 U.S.C. § 1531 *et seq*.
[41] *See* Notice of Final Determination of the Assistant Administrator for Water Pursuant to Section 404(c) of the Clean Water Act Concerning the Proposed Yazoo Backwater Area Pumps Project in Issaquena County, MS, 73 Fed. Reg. 54398 (Sept. 19, 2008), *available at* http://water.epa.gov/lawsregs/guidance/cwa/dredgdis/upload/2008_09_19_wetlands_YazooFinalFedReg9-19-08.pdf (expressing numerous concerns when commenting on the Draft EIS in April 1982, the Final EIS in May 1983, the Draft Supplemental EIS in November 2003, the revised draft Wetland and Mitigation for the Draft Supplemental EIS in December 2005, and the Final Supplemental EIS in January 2008); Notice of Proposed Determination To Prohibit, Restrict, or Deny the Specification, or the Use for Specification, of an Area as a Disposal Site; South Platte River, 54 Fed. Reg. 36862 (Sept. 5, 1989), *available at* http://water.epa.gov/lawsregs/guidance/wetlands/upload/Two-Forks_PD.pdf (commenting on the final EIS in March 1998); EPA Region III, Final Determination of the U.S. Environmental Protection Agency's Assistant Administrator for Water Pursuant to Section 404(c) of the Clean Water Act Concerning the Proposed Ware Creek Water Supply Impoundment, James City County, Va, at 14-18 (July 10, 1989), *available at* http://water.epa.gov/lawsregs/guidance/wetlands/upload/WareCreekFD.pdf (reviewing the draft EIS and final EIS); Water Pollution Control; Final Determination Concerning the Proposed Lake Alma Recreational Lake Project on Hurricane Creek, Bacon County, GA, 54 Fed. Reg. 6749, 6750 (Feb. 14, 1989), *available at* http://water.epa.gov/lawsregs/guidance/wetlands/upload/LakeAlma404-c-FinalFRN-1989.pdf (EPA had commented on the final EIS); Notice of Final Determination of the Assistant Administrator for Water Pursuant to Section 404(c) of the Clean Water Act Concerning the Spruce No. 1 Mine, Logan County, WV, 76 Fed. Reg. 3126 (Jan. 19, 2011), *available at* http://water.epa.gov/lawsregs/guidance/cwa/dredgdis/upload/Spruce_FR_Notice_011911.pdf (EPA commented on the draft EIS and final EIS).

impacts of a particular project, as proposed by the applicant.[42] It also allows the Corps and applicant to respond meaningfully to EPA's stated concerns about the potential environmental impacts by amending the project or increasing mitigation. EPA should not attempt to substitute a Section 404(c) veto process for the more thorough process required by NEPA, which includes important public participation opportunities and a full evaluation of the potential impacts of the project, including social and economic impacts.

Many entities, including EPA and environmental organizations such as NRDC, have emphasized the importance of the NEPA process to government decision-making, including the fact that NEPA review can lead to mitigation that allows a project to move forward without unreasonable impacts on the environment. The NRDC states:

> NEPA is democratic at its core. In many cases, NEPA gives citizens their only opportunity to voice concerns about a project's impact on their community. When the government undertakes a major project such as constructing a dam, highway, or power plant, it must ensure that the project's impacts -- environmental and otherwise -- are considered and disclosed to the public. *And because informed public engagement often produces ideas, information, and even solutions that the government might otherwise overlook, NEPA leads to better decisions -- and better outcomes -- for everyone.* The NEPA process has saved money, time, lives, historical sites, endangered species, and public lands while encouraging compromise and cultivating better projects with more public support.[43]

EPA itself also often comments on the importance of a full and integrated NEPA review for Corps projects.[44] The Pebble Project should not be acted upon without the NEPA review process that NRDC, EPA and others consider the gold standard for environmental impact assessment.

The NEPA EIS process has been designed and implemented to facilitate public participation and the participation of multiple interested federal and state agencies, including EPA. The public, and EPA, would participate in developing the scope for an EIS as well as the

---

[42] EPA has a clear statutory role in the NEPA process. Under Section 309 of the Clean Air Act, EPA is required to review and comment on all EISs prepared under NEPA. Under this authority, EPA reviews both draft and final EISs and provides feedback to the lead agency. If EPA determines that the agency's response to its comments is insufficient and still has objections to the final EIS, EPA can refer the final EIS to the Council on Environmental Quality ("CEQ").

[43] Natural Resources Defense Council, *Why Is the National Environmental Policy Act So Important?*, http://www.nrdc.org/legislation/nepa-success-stories.asp (last visited Apr. 25, 2014) (emphasis added).

[44] *See, e.g.*, EPA Region 10 Letter to ACOE Project Manager in Portland, OR (Apr. 5, 2012) ("Finally, we encourage the Corps to integrate environmental review and consultation requirements into a single NEPA process. For example, integrating the NEPA process with those tor permitting under Section 404 of the Clean Water Act and consultation under Section 106 of the National Historic Preservation Act would result in streamlined and consistent agency decision-making, enhanced public disclosure, and better predictability for the applicant."); EPA Region 10 Letter to ACOE Seattle District (Jan. 22 2013) (commenting that the Corps should consider a range of impacts and noting that "[t]he purpose of an EIS is both to provide decision makers with necessary information regarding potential environmental impacts before a decision is made and to inform the public debate.").

content of the EIS itself. Under CEQ regulations, federal agencies must "make diligent efforts to involve the public in preparing and implementing their NEPA procedures."[45] The agency proposing any action subject to NEPA must publish a Notice in the Federal Register to initiate the NEPA process and invite public comments on the scope of the issues to be addressed in the EIS, including through scoping meetings. Cooperating agencies must be identified to participate at the earliest possible time, including other federal agencies, state and local agencies, and Indian tribes. The draft EIS, which includes a detailed analysis of alternatives, must be published for further public comment. A full response to comments must be prepared before the final EIS is issued. This contrasts sharply with EPA's chosen 404(c) course, which the Agency itself has described as having "no real public discussion[;] public involvement is to comment, then sue if they have the resources."[46]

NEPA also provides that economic and social effects of a proposed action are to be assessed in an EIS. Specifically, the CEQ regulations provide: "[w]hen an environmental impact statement is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the environment."[47] In the case of a proposed mine development project, social and economic benefits are typically detailed in the draft and final EIS, including:

- Direct jobs associated with the development project;
- Training and employment opportunities for unemployed people living in the region;
- Indirect jobs in the local regions (state, national);
- Annual local payrolls;
- Annual capital and operating expenditures;
- Contracting, land development and capacity-building opportunities for Native Corporations and Tribal governments;
- Reduced costs of energy and transportation of goods for those living in the region (due to development of new project infrastructure;
- Impact on the national economy;
- State, federal, and local tax payments; and
- Royalty payments to government entities.

[45] 40 C.F.R. § 1506.6(a).
[46] Exhibit A, Bristol Bay 404(c) Discussion Matrix, at 2.
[47] 40 C.F.R. § 1508.14.

EPA admits that the Assessment does not attempt to measure considerations such as the economic benefits a project may have.[48] The fate of the Pebble Project cannot be rationally decided without consideration of the full social, economic and environmental impacts of the project, and this information will be developed through the NEPA process. Considering the potential benefits of a project is even more critical considering the dire economic circumstances in the region. Many of the villages near the Pebble Project have poverty levels of over a third of the population.[49] High unemployment levels have forced significant migration to Anchorage and other cities.[50] For example, the population of the Lake and Peninsula Borough declined 17% between 2000 and 2010, while the Bristol Bay Borough lost more than 23% of its population.[51] In several communities, schools have closed or are threatened with closure as a result of diminishing enrollment.[52] Consideration of the Pebble Project must take these local economic factors into account.

As the National Academy of Sciences/National Research Council ("NAS") advised the U.S. Congress, "The NEPA process is the key to establishing an effective balance between mineral development and environmental protection. The effectiveness of NEPA depends on the full participation of all stakeholders throughout the NEPA process."[53] NAS further stated,

> The Committee believes that the NEPA process and its various state equivalents provide the most useful and efficient framework for evaluating proposed mining activities for three reasons. First, the NEPA process provides the most comprehensive and integrated framework for undertaking these evaluations. . . . It allows for clear identification of tradeoffs between different and sometimes competing values, and promotes a better understanding by all stakeholders of the implications of the many decisions involved in the preparation and approval of a mine's operating plan. . . . No other regulatory program provides such a comprehensive, integrated mechanism for decision making. Second, the NEPA process ensures that the decisions are based on careful analyses of site-specific conditions . . . . Third, mining technology for a site can vary substantially, depending on the type of ore, the nature and extent of the ore deposit, and many other site-specific conditions . . . . For all these reasons, the Committee believes that the agencies should continue to rely to the maximum extent possible

---

[48] *See, e.g.* EPA, Response to 2013 Public Comments, at 388 ("The scope of the assessment is limited to potential risks to salmon from large-scale surface mining . . . and does not include an analysis of direct socioeconomic impacts on local communities.").

[49] *See* IHS, The Economic and Employment Contributions of a Conceptual Pebble Mine to the Alaska and United States Economies at 17 (May 2013), *available at* http://corporate.pebblepartnership.com/files/documents/study.pdf [hereinafter IHS Study].

[50] *Id.* at 17-18.

[51] *See* Alaska Dep't of Labor, Alaska Economic Trends, at 7 (Apr. 2013), *available at* http://labor.alaska.gov/trends/trends2013.htm.

[52] *See* Lake and Peninsula Borough Comprehensive Plan Update, at 5, 14-15, (Sept. 2012), *available at* http://www.lakeandpen.com/index.asp?Type=B_BASIC&SEC={45A96F5A-83C3-4865-9D03-D19E541FAFC1}&DE=.

[53] National Research Council, *Hardrock Mining on Federal Lands* 6 (National Academy Press 1999).

on the flexible, comprehensive NEPA evaluation process for making permitting decisions. [54]

As the NAS report describes, the NEPA process is vital to a full and objective review of the Pebble Project. EPA's proposed Section 404(c) process would not provide the same comprehensive review because it would not be based on an actual application and would be focused only on theoretical aquatic resource impacts of a theoretical project. An EIS would include a careful and systematic review of all of the impacts of the project, as specifically proposed by the applicant, as well as reasonable alternatives, as explored by federal, state and local regulatory agencies, and a full complement of project- and site-specific mitigation measures. The public, the Corps, EPA, tribes and the State would all be able to participate in developing the scope and content of the EIS. The State, tribes and local communities with a stake in the economics of the area could provide needed input concerning the economic and social impacts of the Pebble Project, including the salutary economic impact of expanded employment opportunities and augmentation of social services afforded by the presence of this project. Moreover, the participation of the sponsors of the Pebble Project in conjunction with that of the public in the NEPA process could yield mitigation measures or alternatives that answer many of the concerns EPA has raised regarding the project.

In the past, EPA has only exercised its 404(c) authority as a last resort, after it has reviewed a proposed Corps permit decision, provided any objections or comments through the NEPA process, and given the Corps and applicant an opportunity to address EPA's concerns through amended project design and/or project- and site-specific mitigation. EPA should continue that precedent in this case, as to act preemptively without a specific project proposed or full CWA and NEPA record would be legally unsupportable. These established procedures are the best means to achieve EPA's goal of assuring certainty to affected parties. Moreover, EPA scientists within ORD have admitted that the NEPA permitting process would be more rigorous, comprehensive, and better suited to regulatory decision-making than the Assessment.[55] Abandoning the NEPA process – particularly when there could be no environmental harm in letting the process unfold – is counter-productive and inconsistent with EPA precedent.

III. The Assessment Does Not Provide a Legitimate Basis for Section 404(c) Action

EPA explains in its February 28, 2014 letter[56] that its decision to proceed under Section 404(c) is based in large part on EPA's Assessment.[57] However, EPA's Assessment does not provide a legitimate basis for determining that the Pebble Project will cause an unacceptable adverse effect to important fishery areas in the Bristol Bay Watershed for the following reasons:

---

[54] *Id.* at 108-10.

[55] *See, e.g.*, Response to Peer Review Comments, *supra* note 34 at 82 ("The assessment is sufficiently comprehensive to meet its stated purpose. It is not intended to be an environmental impact assessment."), *id.* at 165 ("The assessment is not intended to duplicate or replace a regulatory process . . ."), *id.* at 217 ("[D]etailed evaluation of those effects will be left to the NEPA and permitting processes should a mine be proposed.").

[56] *See* Feb. 28, 2014 EPA Letter at 1.

[57] We note that EPA has directed the Pebble Limited Partnership to review Chapter 14 of the Assessment for specific criticisms of the proposed Pebble Mine Project. However, Chapter 14 only provides an integrated risk characterization for the three hypothetical mine scenarios.

- The Assessment evaluates mine scenarios largely of EPA's creation, which do not reflect modern mine engineering and environmental management practices. The Assessment's failure to consider modern mining practices led to numerous flaws in the Assessment, including:
    - Projected impacts on downstream water quality, water flows and aquatic habitat are greatly exaggerated.
    - Risks associated with tailings storage and other project features and operations are significantly overstated.
- PLP has not yet defined a proposed development plan for the Pebble Project; accordingly, footprint impacts associated with the Assessment's mine scenarios are entirely speculative.
- The Assessment does not account for the robust compensatory mitigation measures (related to both aquatic habitat and wetlands) required of such a project.
- The Assessment does not come close to demonstrating adverse effects on aquatic resources, including quantifying impacts to fisheries, and therefore provides an insufficient foundation for taking any action under CWA § 404(c).
- EPA's process and communications before and during the publication of the Assessment demonstrate the document's predetermined outcome and bias.

Each of these issues is discussed further below.

A. The Assessment's Mine Scenarios Are Unrealistic Because They Lack Modern Engineering Design and Environmental Management Practices

The Assessment presents three mine scenarios that were developed by EPA, not PLP: Pebble 0.25, Pebble 2.0 and Pebble 6.5. Each of these have similar project components (open pit, tailings and waste rock storage facilities) but different footprint sizes and locations.[58] The Assessment acknowledges that the scenarios "are not based on a specific mine permit application and are not intended to be the detailed plans by which the components of a mine would be designed."[59] In fact, EPA admits that"[t]he exact details of any future mine plan for the Pebble deposit or for other deposits in the watershed will differ from our mine scenarios."[60]

The Assessment also states that EPA's Pebble 2.0 and Pebble 6.5 mine scenarios (though not Pebble 0.25) are based on "preliminary mine details put forth in Northern Dynasty Minerals' Preliminary Assessment of the Pebble Mine (Ghaffari et al. 2011)."[61] It notes that NDM's

[58] *See Assessmen*t, at 6-1.
[59] *Id.* at 6-1.
[60] *Id.* at Executive Summary, at 10.
[61] *Assessment*, at 6-1.

Preliminary Economic Assessment report (characterized by EPA as *Ghaffari et al*) states that the mine concepts it presents are considered "economically viable, technically feasible and permittable."[62]

It is important to understand that the NDM study upon which EPA has based two of its mine scenarios is only a preliminary assessment of the *economic* potential of the Pebble deposit. It does not present a detailed or even substantive *engineering* analysis of any proposed development, nor the detail of any underlying plans, strategies and technologies for managing environmental effects. Moreover, the NDM Preliminary Economic Assessment is now out of date and does not reflect the current status of engineering and project planning at Pebble: "The project description that the Pebble Partnership ultimately elects to submit for permitting under NEPA may vary in a number of ways."[63]

In its most recent corporate filings, Northern Dynasty has provided further guidance that the mine development concepts presented in the 2011 Preliminary Economic Assessment are no longer relevant:

> However, since the withdrawal of Anglo American from the Pebble Partnership in late 2013 and in light of more recent stakeholder and regulatory feedback, Northern Dynasty initiated a comprehensive review of previous analyses of the Pebble Project, including the 2011 PA and various project components. Current studies of the Pebble Project investigate new infrastructure plans as well as lower throughput rates in a revised project development concept. As well, the cost and revenue inputs require updating given the nearly 4 years which have passed since the 2011 PA was done. For these reasons, any project which is ultimately put forward for permitting will almost certainly be different from the economic assessment model examined in the 2011 PA. Therefore conclusions in the 2011 PA study may have limited going-forward relevance at this time.[64]

In characterizing the mine development concepts presented in the NDM Preliminary Economic Assessment as "permittable", its authors acknowledge that, in their view, pending the application of modern engineering design and project-specific mitigation measures (including compensatory mitigation for unavoidable impacts to aquatic habitat and wetlands), each of the development concepts could achieve necessary federal and state permits. As the NDM Preliminary Economic Assessment states:

> Before a decision is made to initiate permitting, the Pebble Partnership will undertake a comprehensive suite of environmental and social impact analyses, and an Environmental and Social

[62] Northern Dynasty Minerals Ltd., Preliminary Assessment of the Pebble Project, Southwest Alaska, at 4 (Feb. 15, 2011) [hereinafter NDM Preliminary Economic Assessment].
[63] *Id*. at 60.
[64] Management Discussion and Analysis, Year Ended December 31, 2013, Northern Dynasty Minerals Ltd., page 6.

> Impact Assessment. These will provide a rigorous, science-based analysis to demonstrate that the project will meet permitting requirements in Alaska, as well as international best practice for project development.[65]

Notwithstanding this description of work remaining to be done to demonstrate the "permittability" of the mine concepts in the NDM Preliminary Economic Assessment, EPA characterizes its mine scenarios as "realistic, plausible descriptions of potential mine development phases, consistent with current engineering practice and precedent."[66] EPA also variously describes the mine scenarios in its Assessment as being based on "components" [67]or "elements"[68] of NDM's Preliminary Economic Assessment, while at other times describing them as based on "a preliminary mine plan,"[69] "a mine plan that could be submitted (to permitting agencies)"[70] and even "complian[t] with current regulatory standards."[71] Finally, EPA states: "Many of the details of a mine plan may differ from what we have described. However, the essential elements of a mine plan are represented here and would have similar effects regardless of modifications implemented."[72]

In reality, the environmental effects of the mine scenarios presented in EPA's Assessment would vary tremendously based on the actual facility footprint proposed, detailed engineering design, environmental management practices and project-specific mitigation approaches ultimately employed. EPA's claims to the contrary – which assumedly are made to bolster its case and predetermined outcome that the environmental effects of mine development concepts presented in NDM's Preliminary Economic Assessment can be predicted in the absence of detailed engineering designs and underlying plans, strategies and technologies for managing environmental effects – is demonstrably false.

Thus, while EPA's Assessment characterizes two of its mine scenarios as derived from Northern Dynasty, the detailed engineering design and environmental management assumptions made with respect to Pebble 2.0 and Pebble 6.5 (as well as to Pebble 0.25) are entirely of EPA's fabrication.

NDM's Preliminary Economic Assessment states that "international best practice" standards will be the basis for project engineering and operating plans proposed by PLP.[73] Project components that prevent, mitigate and (where necessary) compensate for environmental effects are key aspects of international best practice. To the degree that the mine scenarios in

---

[65] NDM Preliminary Economic Assessment, at 387.
[66] *Assessment*, at 6-1.
[67] EPA, Response to Public Comments on the May 2012 Draft of An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay Alaska, at 65 (Jan. 2014).
[68] *Id.* at 72.
[69] *Id*. at 58.
[70] *Id. at* 96.
[71] EPA, Response to Public Comments on the April 2013 Draft of An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay Alaska, at 119.
[72] Response to Public Comments 2012, at 72.
[73] NDM Preliminary Economic Assessment, at 387.

EPA's Assessment ignore such components, it does not comply with international best practice and cannot be accurately said to be based upon NDM's Preliminary Economic Assessment.

There is considerable evidence that many of the engineering and environmental management assumptions EPA applies to its mine scenarios in its Assessment do not reflect "international best practice" – the most progressive and protective engineering standards and environmental management approaches available to mine developers today. These approaches will be required of proponents seeking mine development permits in the Bristol Bay region of Southwest Alaska, and Pebble owners are committed to adopting them.

Numerous examples of instances in which EPA's mine scenarios do not meet international best practice standards are provided below, along with evidence that the project impacts and risks presented in EPA's Assessment are greatly exaggerated.

1. The Assessment's Projected Impacts on Downstream Water Flows are Greatly Exaggerated

PLP has not yet proposed a development plan for the Pebble Project, so EPA's estimate of flow reductions in the three tributary streams closest to the deposit (North & South Fork Koktuli and Upper Talarik Creek, as shown in Map 1 below) under each of the three mining scenarios presented in the Assessment are entirely speculative. As demonstrated below, the flow reduction estimates are also grossly exaggerated.

Evidence of bias and exaggeration is reflected in the metric that EPA uses to report stream flow changes. "Million cubic meters per year" is not a standard unit for use by stream habitat scientists, engineers or hydrologists to estimate stream flow changes, but its use allows EPA to report massive numbers in its Assessment, thereby creating the impression of significant water loss. Habitat responses to stream flow changes are typically measured by scientists using "cubic meters per second" or "cubic feet per second". Accordingly, rather than the projected 4, 26 and 27 million m^3 per year estimate provided in the Assessment, the appropriate measure of stream flow change under EPA's three mine scenarios would be 0.1, 0.8 and 0.9 m^3per second, respectively.

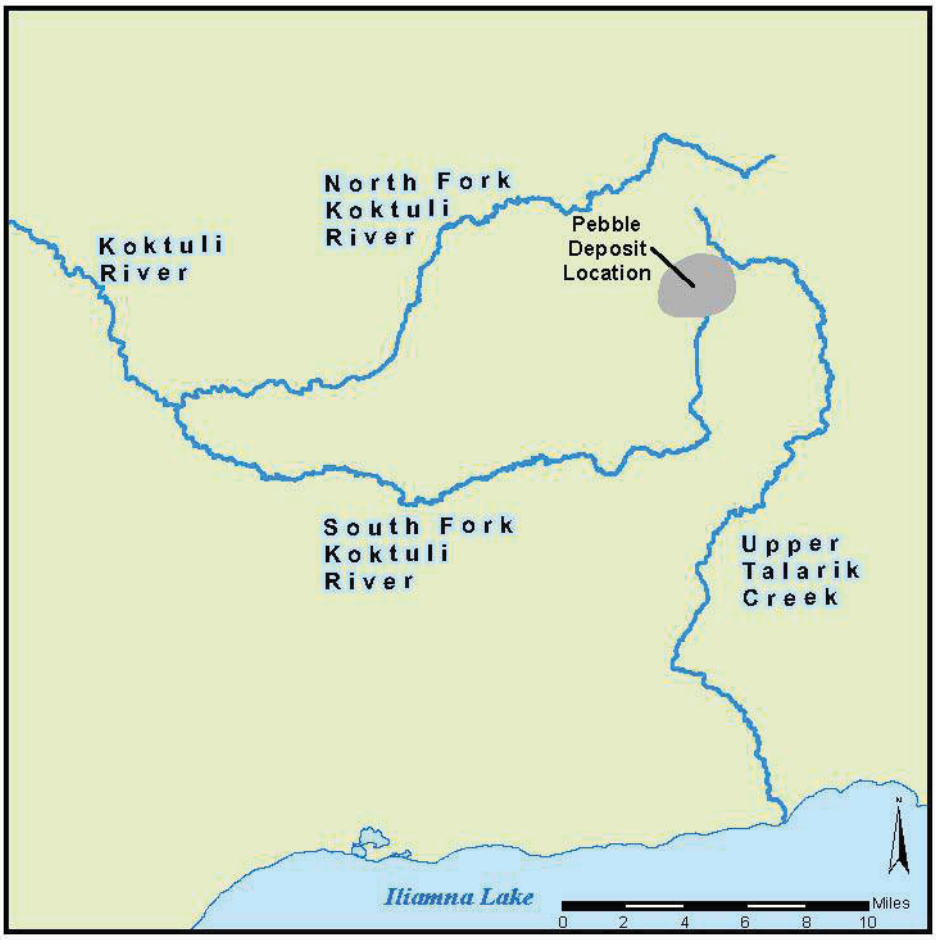
Predicted flow effects associated with EPA's mine scenarios are also exaggerated because the flow reductions modeled in the Assessment are contingent on assumptions made about how, when and where surplus waters are released into nearby streams following treatment. Importantly, and as discussed below, it appears EPA has under-estimated by more than 80 percent the surplus water volumes available for treatment and release to mitigate potential effects to downstream aquatic habitat.

In its Assessment, EPA assumes no release of surplus water to Upper Talarik Creek and instead speculates that half of all surplus water would flow to the North Fork Koktuli and half to the South Fork Koktuli at a steady rate during mine operations.[74] ***This is a wholly arbitrary assumption, and one that would not be allowed by state or federal regulatory agencies. A thorough permit and EIS analysis would identify EPA's surplus waters release strategy as a***

[74] *Assessment*, Tables 7-16, 7-17, & 7-18 (Pages 7-44, 7-45, & 7-46 respectively).

significant design flaw and would direct the proponent to re-submit more appropriate and science-based plans.

MAP 1. Deposit Area Streams



However, EPA's assumption appears to be designed to allow the Assessment to characterize downstream flow impacts in as extreme a fashion as possible. As discussed below, the effect of stream flow reductions on downstream aquatic habitat associated with EPA's three mine scenarios would have been substantially reduced had a more strategic and science-based surplus water release strategy been employed. That said, even the exaggerated flow reductions presented in the Assessment are minor when put into context of total flows in the three streams closest to Pebble, and inconsequential when put into context of total flows in the Nushagak/Kvichak river systems (Map 1) and overall Bristol Bay watershed (Map 2).

TABLE 1
Local and Regional Stream Flow Changes with EPA's 50:50:0 Surplus Flow Distribution

EPA Mining Scenario	Annual water consumption	Change North Fork Koktuli flows	Change South Fork Koktuli flows	Change Upper Talarik Creek flows	Change Nushagak flows	Change Kvichak flows	Change total Bristol Bay flows
Pebble 0.25	4 million m3/yr (0.13 m^3/s)	+ 0.4%	– 1%	– 2%	–0.01%	–0.03%	– 0.01%
Pebble 2.0	26 million m^3/yr (0.82 m^3/s)	-3%	-4%	-8%	- 0.05%	- 0.1%	- 0.03%
Pebble 6.5	27 million m^3/yr (0.85 m^3/s)	+ 6%	-10%	-15%	- 0.01%	0.19%	- 0.03%

(All values in Table 1 are derived from the three mine scenarios presented in EPA's Assessment, and calculate the percentage change in mean annual flow in stream and river systems surrounding Pebble as a result of releasing 50% of surplus waters into of the North and South Fork Koktuli and none into Upper Talarik Creek).

MAP 2. Major Hydrology Features in the Region

As further evidence of the minor effects that EPA's assumed flow changes would have on local streams, the Assessment cites the following thresholds (sourced from a peer reviewed study[75]) for ecosystem impacts associated with changes to natural flows in a stream or river system:[76]

- "*Streamflow alteration below 10% would cause minor impacts on the ecosystem with a relatively high level of ecosystem protection.*
- "*Streamflow alteration of 11 to 20% would cause measurable changes in ecosystem structure and minor impacts on ecosystem function.*
- "*Streamflow alteration of greater than 20% would cause moderate to major changes in ecosystem structure and function. Increasing alteration beyond 20% would cause significant losses of ecosystem structure and function.*"[77]

[75] *See Assessment*, at 15-32 (citing Richter, B., et al, A Presumptive Standard for Environmental Flow Protection, *River Research and Applications* 228: 1312-1321).
[76] *Assessment*, at 7-53.
[77] *Id.*

As shown in Table 1 above, all but one of the flow changes estimated by EPA in local streams is 10% or less and thus would provide *"a relatively high level of ecosystem protection"* and even that one would involve only "*minor impacts on ecosystem function*" in only one location. The exception is Upper Talarik Creek, the one stream near Pebble to which EPA elected to release no surplus flows.

Had EPA selected a more strategic and science-based strategy for releasing surplus waters, each of the streams surrounding Pebble would fall well below this 10% threshold for all three mining scenarios. For instance, had EPA selected another arbitrary, but slightly more reasonable surplus water release strategy – that is, releasing one-third of all surplus waters into each of the three streams at a steady rate over the course of each year – average flow reductions in Upper Talarik Creek, and the North and South Fork Koktuli would all fall well below the acceptable 10% threshold for each EPA mine scenario, with the result that in ALL instances the estimated flow change would involve "*a relatively high level of ecosystem protection*" (as shown in Table 2 below).

TABLE 2
Local and Regional Stream Flow Changes with Equal Surplus Flow Distribution

EPA Mining Scenario	Annual water consumption (EPA_	Change North Fork Koktuli flows	Change South Fork Koktuli flows	Change Upper Talarik Creek flows
Pebble 0.25	4 million m3/yr (0.13 m^3/s)	-0.9%	- 1%	– 1%
Pebble 2.0	26 million m^3/yr (0.82 m^3/s)	- 5.5%	-4%	- 4.6%
Pebble 6.5	27 million m^3/yr (0.85 m^3/s)	- 5%	-7%	-6 %

(All values in Table 2 are derived from the three mine scenarios presented in EPA's Assessment, and calculate the percentage change in mean annual flow in stream and river systems surrounding Pebble as a result of releasing 33.3% of surplus flows into each of the North and South Fork Koktuli and Upper Talarik Creek).

Just as importantly, the flow reductions for the three streams surrounding Pebble under each of the Assessment's three mine scenarios is an average for the whole stream. Flow reductions would be greatest in the upper reaches of these streams where habitat values are lowest, and lowest in lower reaches of these streams where habitat values are highest. This is a result of natural inflows to each stream system increasing in downstream reaches; a natural dynamic that would further mitigate against negative flow effects on habitat – particularly the most productive habitat. Nonetheless, these stream segment differences in flow effects are another reason that what is required, and what is standard practice when properly designing mining projects, is a more sophisticated flow and habitat modeling approach to a water release strategy than the arbitrary and unpermittable one used in the Assessment.

In the Assessment, the strategy EPA employs for releasing treated surplus waters to nearby streams is erroneously attributed to Northern Dynasty Minerals Ltd. – specifically to the

NDM Preliminary Economic Assessment report published in 2011.[78] While NDM's Preliminary Economic Assessment does state that the mine development concepts it presents would capture and store surplus water, and that surplus waters would be treated and subsequently released to nearby streams to optimize downstream aquatic habitat, it does not provide a specific surplus water release strategy, nor does it specify where or how much surplus water would be released from the Water Treatment Plants.[79]

EPA claims otherwise, stating that the surplus water release strategy presented in the Assessment is wholly derived from Northern Dynasty.[80] This is incorrect. Project water consumption estimates and surplus water volume estimates are not presented in NDM's Preliminary Assessment nor is any surplus water release strategy provided. ***Thus, the surplus water release strategy discussed in the Assessment is a fabrication attributable solely to EPA.*** EPA's characterization of it as being sourced from NDM is inappropriate and misleading.

PLP has also determined that EPA's hydrology estimates for the watersheds surrounding Pebble, as presented in the Assessment, are incorrect. Based on extensive hydrological studies undertaken over the past 10 years, PLP estimates that about five times as much surplus water will be available for treatment and release to mitigate downstream effects on aquatic habitat than the Assessment predicts.

In addition, PLP has developed a far more sophisticated model for assessing and managing the effects of flow changes on downstream aquatic habitat than the method EPA utilized in its Assessment. The Physical Habitat Simulation ("PHABSIM") model, originally developed more than 30 years ago by the U.S. Geological Survey ("USGS") and U.S. Fish and Wildlife Service ("USFWS"), is the most scientifically advanced and widely accepted methodology for determining aquatic habitat versus stream flow relationships. At Pebble, it has the added benefit of helping determine the best possible surplus water release strategy to optimize downstream habitat conditions for salmon and resident fish. Pebble's PHABSIM model is built upon some 10 years of site-specific stream flow monitoring and aquatic habitat surveys in the three streams surrounding the Pebble deposit, and can predict habitat availability for four species of salmon and three species of resident fish in hundreds of catalogued stream reaches at different times of the year and for different life stages.

When PLP finalizes a development plan for Pebble and applies for federal and state permits, it will propose a science-based surplus water release strategy based on PHABSIM modeling and local ecological considerations. Rather than releasing 50 percent of all surplus water into the North Fork Koktuli and 50 percent into the South Fork Koktuli at a steady rate each year, and none into Upper Talarik Creek, PLP will regulate precisely how much water goes into each watercourse at different times of the year to optimize downstream habitat conditions and avoid "unacceptable adverse effects."

To demonstrate both the sophistication and superior outcomes of using PHABSIM modeling to determine an optimal surplus water release strategy, PLP has applied this approach

[78] *Assessment*, at 6-1.
[79] NDM Preliminary Economic Assessment, at 366, 51, 53.
[80] *Assessment*, at 6-27.

to a project of similar footprint size and scale to EPA's Pebble 2.0 mine scenario. Based on PLP's more accurate estimates of surplus water available for treatment and release, PLP has applied PHABSIM modeling to generate a science-based surplus water release strategy that actually improves habitat availability for most anadromous and resident fish species.

The resulting changes in habitat availability in the three tributary streams surrounding Pebble (as shown in Table 3 below) would have no discernible effect on local fish populations or the regional fisheries they support, and may in fact be beneficial for some species.

TABLE 3
Fish Habitat Changes in the North Fork and South Fork Koktuli and Upper Talarik Creek based on a Mine Scenario comparable to EPA's Pebble 2.0 and Available Restorative Flows as determined by PLP's PHABSIM Modeling

Species	Spawning habitat % change	Rearing habitat % change	Total habitat % change
Sockeye	+1.2	+1.5	+1.3
Chinook	-1.8	+2.8	-0.01
Coho	+0.4	0	+0.3
Chum	+0.9	0	+0.9
Arctic grayling	+10.2	+0.1	+5.4
Dolly Varden	+2.1	+0.4	+1.7
Rainbow Trout	+12.5	+2.5	+8.4

For the vast majority of fish species – including commercially important Sockeye salmon as well as for Coho and Chum salmon, Arctic Grayling, Dolly Varden and Rainbow Trout – flow changes resulting from a mine scenario comparable to EPA's Pebble 2.0 mine scenario following a PHABSIM-guided surplus water release strategy would improve both spawning and rearing habitat availability. A small reduction in availability of Chinook salmon spawning habitat is the only negative impact modeled, although this change is minor – particularly in the context of overall Chinook habitat in Nushagak and Kvichak drainages and the broader Bristol Bay region. No discernible effect on Chinook salmon populations or the regional fisheries they support would occur, particularly inasmuch as Chinook salmon spawning habitat availability is not a limiting factor in any of the three drainages surrounding Pebble. This conclusion is further supported by the additional productive capacity resulting from significant opportunities for compensatory mitigation for unavoidable impacts on aquatic habitat detailed later in this submission.

These modeled results illuminate the significant shortcomings of the Assessment as a scientific document upon which to base a regulatory decision. EPA's scientific understanding of surplus waters available to offset flow reductions is flawed. Its assumptions about the surplus water release strategy are wholly arbitrary (rather than science-based). And the scientific analysis the Agency uses to forecast the effect of flow changes is grossly inadequate. That EPA then incorrectly attributes its surplus water release strategy to Northern Dynasty only exacerbates the lack of scientific integrity associated with the Assessment.

In contrast to the sophisticated PHABSIM modeling above – which quantifies habitat availability changes for seven species of anadromous and resident fish at different life stages, different times of the year and different locations throughout the North Fork and South Fork Koktuli and Upper Talarik Creek drainages – EPA's estimate is both overly simplistic and under-informed. The Assessment predicts that stream flow alterations exceeding 20% would adversely affect habitat in 9, 17 and 33 miles of stream downstream of Pebble 0.25, Pebble 2.0 and Pebble 6.5 respectively.[81]

Not only are these estimates based on the Assessment's arbitrary and demonstrably ineffective surplus waters release strategy, they also rely on a simplistic methodology for assessing habitat impacts. For instance, there is absolutely no consideration for the quality or type of habitat affected, despite the fact that those stream reaches likely to experience flow reductions greater than 20% are at the upper reaches of the three tributaries – where habitat values and fish densities are lowest.

One of the key scientific shortcomings of EPA's Assessment is the absence of any data related to fish abundance and density in the streams systems surrounding Pebble. As a result, in describing aquatic habitat in the streams surrounding Pebble, the Assessment only relies on fish distribution – rather than fish use, abundance and density, which are all measures of habitat quality and productivity – to speculate on aquatic habitat effects. The Assessment leaves lay readers with the assumption that all aquatic habitat is equal and plays equally important roles in supporting fish populations, which is empirically not the case. Further, EPA provides no causal link between any flow changes, availability of productive habitat, fish production or resulting fisheries harvests.

In fact, PLP studies have shown that streams at the upper reaches of the three streams surrounding Pebble – those areas most likely to be affected by flow changes associated with mine development – either are not utilized by fish or support low to very low densities of fish. Many dry up in summer and freeze over in winter. And while some areas may support spawning and rearing habitat for small numbers of anadromous and resident fish populations, the availability of such habitat is not a limiting factor for any of these fish populations.[82]

There is another problem with EPA's prediction that 9, 17 and 33 miles of stream downstream of Pebble 0.25, Pebble 2.0 and Pebble 6.5 respectively would experience flow reductions in excess of 20%.[83] It appears the vast majority of stream miles experiencing a 20% or greater reduction in flows in the Assessment occur in the South Fork Koktuli drainage because EPA selected to release surplus waters to a small tributary of the South Fork – leaving miles of the mainstem river upstream of the confluence with this small tributary without any mitigative flows.[84] This is another major flaw in the EPA mine scenario design that contributes to unnecessary and avoidable effects.

---

[81] *Assessment,* Executive Summary, at 13.
[82] PLP, Environmental Baseline Document, at Ch. 15.
[83] *Id.* at 14.
[84] *Assessment*, at 6-31, 7-37, 7-38, & 7-39 respectively.

Most importantly, an EIS completed by the Corps as part of a comprehensive permitting process would measure downstream impacts on aquatic habitat resulting from stream flow changes with the most robust scientific information and analyses available (most likely PHABSIM modeling based on Pebble's EBD data). This analysis would also be informed by an actual mine plan prepared by the proponent, including a scientifically derived surplus water release strategy. Such an analysis would present a far more detailed and scientifically defensible estimate of downstream habitat impacts due to stream flow changes than the Assessment does. Such an analysis will also demonstrate far less severe impacts than EPA has estimated, and would in fact predict habitat improvements for many fish species. More importantly, when taken into consideration with the abundant opportunities for both on-site and off-site compensatory mitigation there would be no "unacceptable adverse impacts."

2. The Assessment's Projected Impacts on Downstream Water Quality are Grossly Exaggerated

In its Assessment, EPA assumes that a significant volume of leachate (untreated water contaminated with naturally occurring metals and other mineral constituents as a result of its contact with mine facilities) will not be captured by water management systems associated with each of its mine scenarios, causing significant downstream water quality effects. However, uncontrolled seepage from both waste rock storage and tailings storage facilities assumed in the Assessment is substantially greater that what would be permitted by federal and state regulatory agencies. It is also substantially greater than what would be expected at a modern mine utilizing conventional seepage design considerations and water management practices. Thus, the Assessment grossly misrepresents the characteristics of a modern mine proposal that would be submitted for permitting.[85]

It is important to note that EPA has not actually modeled the environmental performance of a proposed water management system in its Assessment. Rather, it merely assumes that 50% of all leachate produced from water flowing through waste rock placed outside the open pit drawdown area would escape to the downstream environment.[86] In the case of tailings storage facilities ("TSF"), EPA appears to have assumed that 100% of seepage at the downstream edge of embankments would escape to the environment – meaning the Agency allowed for no seepage collection measures at all.[87] Such a scenario does not reflect modern mine engineering design criteria or international best practice, and could never be permitted in the United States, so it is little wonder that the Assessment reaches conclusions of adverse water quality impacts.

Further, and as noted above, EPA has assumed no seepage collection features will be engineered or built at the downstream edge of its tailings storage facilities. However, NDM's Preliminary Economic Assessment is clear that a "seepage collection system will be installed downstream of these design elements (tailings storage facilities) to capture any seepage that does migrate through them."[88] ***In this instance, it is unavoidably clear that mine scenarios presented***

[85] *See* Exhibit J, Memorandum from Cathy Safadi, Knight Piesold Consulting, to Bruce Jenkins, Response to Final EPA BBWA Report: Leachate from Mine Facilities (Apr. 23, 2014).
[86] *Assessment*, at 8-54 and 8-13.
[87] *Id.* at 8-4.
[88] NDM Preliminary Economic Assessment, at 50.

in EPA's Assessment diverge fundamentally from NDM's Preliminary Economic Assessment and international best practice standards.

EPA has not considered or evaluated the effectiveness of conventional seepage management design approaches, operational practices and adaptive management strategies, yet recognizes in the Assessment that such practices and strategies would be part of a properly designed, operated and maintained mine. Furthermore, conventional seepage management systems employed at modern mines regularly achieve significantly greater seepage capture rates than is assumed in the Assessment.

EPA states in the Assessment: "If waste rock piles are designed properly with appropriate mitigation measures, monitored and maintained, release of contaminants is possible, but unlikely."[89] Despite acknowledging that practices and technologies currently exist to address seepage concerns associated with modern TSFs, EPA chose to apply none of these approaches to the mine scenarios in its Assessment. Instead, EPA blithely assumes that 50 percent of all leachate associated with waste rock piles outside of the pit drawdown zone will be lost to the environment, and uses this assumption to predict exaggerated downstream water quality impacts.

Similarly for the TSF, EPA acknowledges in the Response to Peer Review Comments:

> If a mine at the Pebble deposit goes forward, the design of the TSFs should include a more thorough flow analysis that would calculate the expected rate of flow and associated flow paths from the TSFs. If the calculated leakage rates were unsatisfactory from an environmental, operational, or economic perspective, the designer could incorporate other design elements (e.g. a liner) to reduce the expected leakage rate.[90]

It is ironic that EPA authors suggest additional flow analyses should be undertaken by Pebble proponents, and that project-specific seepage management systems be designed to address downstream water quality concerns, because this is precisely what NDM's Preliminary Economic Assessment states that PLP will do.

Conventional seepage management systems (including those likely to be proposed at Pebble) regularly include:

- seepage collection ponds down-gradient of waste rock piles and TSF areas;
- pumping wells to intercept and reduce potential leachate losses;
- seepage cut-off walls; and
- design, installation and operation of a groundwater monitoring program down-gradient of waste rock piles and TSFs based on site specific mine design and groundwater conditions.

[89] *Assessment*, Appendix I, at 5.
[90] Response to Peer Review Comments, at 167.

Utilizing these and other project and site-specific water management features and technologies, PLP will submit to regulators a water collection/management system (including water treatment plant) that is sufficiently robust to ensure that water quality/chemistry in monitoring wells at the mine perimeter consistently meets all applicable state and federal water quality standards. This proposed water management system will then be subjected to rigorous and sophisticated water quality modeling during mine permitting, and must demonstrate to federal and state regulatory agencies that downstream water quality will be protected through all phases of mine development.

There is a great deal of evidence in the United States and around the world to demonstrate that modern mines engineered and operated using conventional water management practices and technologies that would be required for the Pebble Project consistently maintain downstream water quality. These conventional water management approaches are not considered in the Assessment; rather, EPA has arbitrarily assumed a seepage interception rate that is both out of compliance with federal and state regulation, and demonstrably worse than what would be expected had conventional engineering design and operations practices been applied.

Most importantly, EPA's arbitrary and grossly exaggerated assumptions about downstream water quality impacts associated with its mine scenarios in the Assessment cannot replace the rigorous and sophisticated water quality modeling to be undertaken as part of a permit review and EIS process under NEPA. Not only will the Corps use a science-based predictive model – rather than an arbitrary 50 or 100 percent seepage loss assumption – its forecast will be based on an actual development plan proposed by PLP, including a fully engineered water management system based on project and site-specific criteria.

3. The Assessment Overstates Other Risks Associated with Mine Facilities and Operations

In its Assessment, EPA evaluates the historical performance of TSF embankments around the world, as well as historical performance records for other industrial facilities and operations, to predict the likelihood and consequence of a broad range of operating failures at a modern mine in southwest Alaska.

This predictive model is fundamentally flawed, particularly since the practice of modern engineering is focused on learning from the errors of the past, while applying new approaches to continuously improve operating performance and minimize uncertainty and risk.[91] The principal data source for the Assessment's TSF embankment risk discussion is a 2001 report from the International Commission on Large Dams ("ICOLD"), which evaluated some 220 historical dam accidents and failures dating back as far as 1917.[92] Consistent with the engineering profession's goal of learning from the past to continuously improve operating performance and minimize risk,

[91] *See* Exhibit K, Memorandum from Dan Friedman, Knight Piesold Consulting, to Bruce Jenkins, *Tailings Dam Failure – Related Technical Support for NDM's Response to Final EPA BBWA* (Apr. 23, 2014).
[92] *Assessment*, at 9-7 ("The International Commission on Large Dams compiled a database of 221 tailings dam incidents (events potentially leading to failure) and failures (events in which dams stop retaining tailings as designed) that occurred from 1917 through 2000.").

the stated intent of the 2001 ICOLD study is "to learn…not condemn."[93] The ICOLD database was developed by industry to identify the most relevant causes of TSF failures so as to advance engineering, construction, operational and regulatory approaches to avoid them in the future. Rather than using the database to predict future events (as EPA has done) the purpose of the database is to fundamentally improve TSF performance over time.

Historical failures, many decades old and occurring in countries with significantly less regulatory oversight than the United States, are not a sound basis on which to form regulatory decisions on a modern mine operation at the Pebble deposit. Mines permitted decades ago without the rigor of modern permitting requirements and technological developments in engineering design and construction have had a much higher failure rate than modern mines. ***The historical failure rate of such mines is thus wholly irrelevant to the potential failure rate of a mine using modern technology and complying with the current stringent federal and state environmental and safety requirements.***[94]

Similarly, the Assessment cites a series of studies by Davies et al (2000, 2002) to bolster its predictions about modern TSF embankment failure risk based on historical performance. With Davies as well, EPA has ignored both the study's intent (to improve future performance) and its authors' conclusion: that "there is the potential to essentially eliminate such events with an industry-wide commitment to correct design and stewardship practices."[95]

Ultimately, what these studies of past failures demonstrate is the key design and operating considerations that project proponents and regulators must heed in order to avoid failure, including:

- the vast majority of failures are associated with embankments designed and constructed using the upstream method, rather than the eminently more stable center-line or downstream methods (as anticipated at Pebble);
- embankment foundations must be adequately prepared prior to construction;
- adequate hydrologic and hydraulic evaluations must be performed to ensure embankments are designed with adequate 'freeboard' to resist over-topping, even in the most extreme weather conditions;
- construction practices must be adequately performed, monitored and regulated, in particular to avoid problems associated with inadequate compaction of fill material;
- tailings beaches must be properly maintained;
- underground development must be a suitable distance away from TSF embankments so as to avoid instability associated with subsidence.

---

[93] International Commission on Large Dams (ICOLD).Tailings Dams, Risk of Dangerous Occurrences, Lessons learnt from Practical Experiences, at 55 (2001).

[94] As noted in the 2013 PLP comments, "The statistics that it uses to support this assertion are based on historical dam failures, which to a large extent are not relevant to modern tailings dams because of improved designs, more stringent regulatory oversight, and higher operating standards." Pebble Limited Partnership, *Comments on Second External Review Draft of "An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska"* (Apr. 2013), at 17 ("Pebble Limited Partnership Comments") (citing Knight Piesold Consulting, *Review of the Bristol Bay Assessment*, at 2 (June 28, 2013)).

[95] Davies, M. P., et al., Mine Tailings Dams: When Things Go Wrong, *in* Association of State Dam Safety Officials, U.S. Committee on Large Dams, *Tailings Dams*, at 261-73 (2000).

Professional engineers qualified to design, build and operate modern TSF embankments, as well as the professional regulators who review and oversee their work, understand that all of these considerations can be fully addressed during mine permitting, construction, operations and even following closure. The long-term integrity and stability of any dam structure requires a full understanding of project and site-specific conditions, and a commitment (on behalf of the project operator and regulator) to proper construction, operation, maintenance, monitoring, and enforcement.

Any TSF embankment proposed, permitted, built and operated in southwest Alaska will certainly benefit from the accumulated knowledge presented in the ICOLD and Davies studies. ***In fact, no tailings embankment built since 2000 utilizing a center-line or downstream construction method and located in a jurisdiction with first-world environmental standards and regulatory oversight has ever failed. PLP believes it is this modern safety record – rather than 220 historical incidents of outdated engineering design and poor construction, maintenance and operating histories – that should inform stakeholder understandings of risks associated with TSF embankments in the United States in the 21st century.***

The independent experts retained to peer reviewer the Assessment agree that the TSF embankment risks cited by EPA are significantly overstated for a modern project in Alaska. Dr. Dirk van Zyl commented:

> I expect that a tailings review board will also be used for the Pebble Mine and the behavior of a tailings management facility designed and operated under these conditions will be more representative of the potential failure likelihoods expected for such a facility. It is expected that this likelihood will be much lower than those used in the evaluations of the scenario in the EPA Assessment.[96]

Unfortunately, EPA has published a litany of statistics in its Assessment to posit "Probabilities and Consequences of Potential Failures in the Mine Scenario."[97] These statistics address risks associated with a broad range of possible failures (including pipeline, culvert and water management system failures). However, EPA has relied on historical performance – often for operations and facilities in different countries, operating environments, eras and industries – to predict the performance of a modern U.S. mine in the United States in the 21st century. As a result, the risk estimates are inherently flawed.

A permit review process under the CWA and NEPA would include defensible, science-based risk assessments for all contemplated facility and operating failures associated with mine development, and would consider project and site-specific mitigation strategies to avoid, minimize and respond to such events. Where failures are deemed possible by regulators, project proponents must demonstrate that the associated environmental effects can either be avoided or

[96] *Id.* at 202.
[97] *Assessment*, Executive Summary, at 19.

EXHIBIT A

Bristol Bay 404(c) Discussion Matrix HQ Briefing 9/08/2010		
I. Timing	**Pros**	**Cons**
A. During the permitting process	1. Traditional process 2. Permit and NEPA processes will generate considerable information informing the decision.	1. Proponents will have spent tens of millions of dollars. 2. Little EPA involvement in determining information to be collected and analyzed. 3. If EPA vetoes the resulting permit, only that project would be prohibited, potentially setting up subsequent rounds of permitting, vetoing, etc. 4. Political backlash will be much worse after NEPA and 404 processes.
B. Proactive before permit applications	1. Preamble to the regulations expresses preference for advance 404(c) action. 2. A proactive 404(c) will provide the regulated community clarity on what can and cannot be permitted allowing for more efficient and timely development of permitted projects. 3. An advanced process can facilitate targeted information collection and better planning by project proponents. 4. Promotes sustainability goals. Can serve as a model of proactive watershed planning for sustainability. Similar to "alternative futures" watershed planning being used in Region 10. 5. Responsive to Tribal concerns.	1. Never been done before in the history of the CWA. 2. Immediate political backlash from Alaska. 3. Immediate dedication of resources, however, we would refocus work to address highest priority. 4. Litigation risk.

II. Process	Pros	Cons
A. Regulatory decision making mode – 404(c) process	1. Established legal procedure. 2. EPA control of the process and decision.	1. There is no real public discussion – public involvement is to comment then sue if they have the resources (NEPA, 404 permit, 404(c). 2. EPA would have less control of the "spin" and political debate.
B. Inclusive public discussion : 1) Address three key questions 2) Hold three public information sessions 3) Develop decision document for RA as output	1. EPA can begin the process in a neutral position, collect information, provide information to public, and building a position iteratively. 2. Starting in a neutral position can deflect political backlash. 3. Building a position iteratively by breaking the process into questions to be addressed can help build a public position and derail opposition. 4. Can involve State and Tribes upfront and work to meet their needs.	1. Possible FACA complications, however, process could be structured to alleviate those concerns. 2. Longer timeframe than just starting the 404(c) process 3. More Resources
i. As part of the 404(c) process	1. Established legal/regulatory process/framework	1. Sets precedent for future 404(c) actions. 2. Not adhering strictly to the regulation.
ii. Leading to a decision whether to initiate the 404(c) process.	1. Starts in a neutral position 2. Open and transparent process leading to a public recommendation. 3. Helps to develop a stronger record upfront. 4. Expands on Lisa Jackson's priorities – Protecting America's waters; Expanding the Conversation on Environmentalism and working for Environmental Justice; and building strong State and Tribal Partnerships	1. May have to address complications in representing 36 Tribes.

EXHIBIT B

THE STATE
of ALASKA
GOVERNOR SEAN PARNELL

Department of Law

Office of the Attorney General
1031 West 4th Avenue, Suite 200
Anchorage, Alaska 99501-5903
Main: 907.269.5100
Fax: 907.269.5110

February 3, 2014

Via First Class U.S. Mail and Email to Elkins.arthur@Epa.gov

Mr. Arthur A. Elkins, Jr.
Inspector General
U.S. Environmental Protection Agency
1200 Pennsylvania Ave., NW (2410T)
Washington, DC 20460

Re: Request for Investigation of EPA's Actions in Preparing the Bristol Bay Watershed Assessment

Dear Mr. Elkins:

I write on behalf of the State of Alaska to request an investigation of the EPA's preparation of the Bristol Bay Watershed Assessment. You received a similar request for investigation from Northern Dynasty Minerals Ltd., dated January 9, 2014.

The State is concerned that actual bias within the agency induced EPA to invoke a novel interpretation of its statutory authority to conduct the assessment and led to the development of an assessment that contains findings likely tainted by that bias, which raises serious questions about the scientific and technical integrity of the document.

Beyond that, the State views with alarm the threat posed by a federal agency that can effectively preempt legitimate and lawful State regulatory authority over proposed activities on State lands.[1]

The EPA's unprecedented actions have already had a chilling effect. Facing what appears to be the EPA's pre-determined outcome, one of the partners in the company that has been gathering the costly information and preparing the development and protection plans necessary to apply for permits withdrew from the Pebble project. Another partner is also contemplating withdrawal. The effect on the many other projects in Alaska and throughout the nation that may be assailed by the EPA as a result of its unique interpretation of its authority remains to be seen. This is all the more reason why an immediate investigation is warranted.

---

[1] "Congress does not casually authorize administrative agencies to interpret a statute to push the limits of congressional authority (citation omitted). This concern is heightened where the administrative interpretation alters the federal-state framework by permitting federal encroachment upon a traditional state power." *Solid Waste Agency of Northern Cook County v. United States Army Corps of Engineers*, 531 U.S. 159, 173-74 (2001).

Evidence indicates that even before the EPA announced it would conduct an assessment of the Bristol Bay watershed, its employees collaborated with non-governmental organizations opposed to the Pebble project to devise an analytical process to culminate in EPA's preemptive veto of future applications to develop the Pebble project. The January 9 letter from Northern Dynasty references some of this evidence. We attach additional evidence. We particularly draw your attention to the following examples:

- The U.S. Fish and Wildlife Service appears to have created a document in September 2010 to the effect that EPA had already determined it would veto the Pebble project pursuant to Section 404(c), not only in the Pebble project area, but apparently "a much larger area in southwest Alaska." *See* NDM Exhibit 13, at 1.

- The relative ease and frequency with which EPA staff communicated with representatives of those advocating for a 404(c) veto gives a disconcerting appearance of bias. *See, e.g.*, NDM Exhibits 13-15, 17-19, 22-24; Attachment A. Representatives of non-governmental groups (e.g., Shoren Brown with Trout Unlimited, Wayne Nastri with Dutko Worldwide, Jon Devine with Natural Resources Defense Council, Geoffrey Parker, attorney for the tribes on their petition) appear to have coordinated with federal personnel to help EPA create an assessment process that would culminate in a preemptive 404(c) veto for lands in and adjacent to the Pebble project area. *Id.* For example, when Governor Parnell wrote EPA in September 2010 regarding the petitions, it appears EPA's Palmer Hough (who was a key contributor on the final assessment and lead co-author of Appendix J in Vol. III of the assessment) coordinated with Trout Unlimited regarding the timing and logistics for response. Attachment B. Several of the documents reflect arrangements to talk by phone or in person regarding Pebble and 404(c) issues. Attachment A.

- The bias of former EPA employee Phil North against the development of both Pebble and a separate project on state lands called the Chuitna Coal Project has been well documented. *See, e.g.*, NDM Exhibit 1-4 and 8-10; Attachment C. At the same time as Mr. North advocated for EPA's preemptive veto of the Pebble project, the EPA tasked him to serve as a principal employee to develop, author, and edit the assessment. U.S. Fish and Wildlife Service biologist Phil Brna, who appears to have similarly advocated for a preemptive veto, was also assigned significant roles in the development of the assessment. *See, e.g.*, NDM Exhibits 10 and 12 ; final assessment, at Vol. I, Executive Summary, at xxvi and Volume III, Appendix C.

- In a string of emails sent in December 2010, with a subject line reading "A new development," Trout Unlimited and EPA coordinated what appeared to be a key meeting at the Nature Conservancy's office in Anchorage. Mr. North indicated that at the meeting "[The Conservancy] will be presenting their risk assessment to EPA" and that this was just before "my proposed time to meet to discuss our own

risk assessment." The Conservancy provided EPA an "embargoed" copy of the assessment prior to the December presentation with a request that EPA not circulate the report beyond the agency. At or around the same time, David Chambers, who was retained as an expert for various organizations opposed to the Pebble project, was making recommendations to EPA about individuals that EPA could use to develop EPA's assessment. Attachment D.

All of these communications occurred before EPA's announcement in February 2011 that it would be conducting the assessment. Information from EPA's records shows that even after EPA determined that it would conduct the assessment, communications on significant legal, factual, and policy issues were also taking place between key EPA staff who were working on the assessment (e.g., Mr. North, Mr. Hough, and others) and representatives of third parties opposed to Pebble project (e.g., Jeff Parker, Becca Bernard). Attachments E - I.

The actual or apparent bias demonstrated by the EPA, and its solicitation and coordination with the various groups opposed to the Pebble project is serious enough. However, the State's concerns are magnified by the fact that, in preparing the assessment, the EPA (1) failed to make available all of the underlying reports upon which it relied, even though the State has made repeated requests for this information, including that it be posted to EPA's website; (2) failed to comply with the Information Quality Act; (3) failed to comply with its own peer review process with respect to the peer reviews conducted for the assessment; and (4) relied on material that has not been peer-reviewed or which was prepared by individuals or organizations actively opposed to a potential Pebble Mine. The State has on several occasions documented the above concerns and others in its submittals to the EPA.

We ask that you commence an immediate investigation into this matter. Should you need additional information from the State in considering this request, please do not hesitate to contact me.

Sincerely,

Michael C. Geraghty
Attorney General

Attachments A-I
cc: w/attachments by email
Gina McCarthy, EPA Administrator
Dennis McLerran, Regional Administrator, EPA Region X
The Honorable Lisa Murkowski
The Honorable Donald Young
The Honorable Mark Begich
The Honorable Sean Parnell
Commissioner Larry Hartig, ADEC

EXHIBIT C

Ecofish Research Ltd.
906 – 595 Howe Street
Vancouver, B.C. V6C 2T5
Phone: 604-608-6180
Fax: 604-559-6180
info@ecofishresearch.com
www.ecofishresearch.com

April 24, 2014

Reference: 1042-02

Northern Dynasty Minerals Ltd.
1040 West Georgia Street, 15th Floor
Vancouver, BC V6E 4H1

Attention: Bruce Jenkins

Re: Literature review of successes and efficacy of fish habitat restoration and compensation projects in British Columbia.

1. INTRODUCTION

Watersheds provide essential ecosystem and societal services in British Columbia (BC), including the production of anadromous salmon (*Oncorhynchus spp.*) and other freshwater fish species. Strong societal interest in maintaining and enhancing salmonid and other freshwater fish populations has prompted substantial efforts to restore or rehabilitate riverine habitats in BC. This has become particularly important as natural (e.g., freshwater disturbances, ocean conditions) and anthropogenic influences (e.g., industrial development, fisheries) affect watershed functioning and fish production.

Aquatic restoration in British Columbia is founded on many decades of research on watershed processes, limitations to salmonid production in streams, and fish habitat rehabilitation techniques. Because these factors are becoming more and more understood, humans can successfully rehabilitate habitats that mimic or enhance natural processes in support of increased salmonid production.

Ecofish Research Ltd. was retained by Northern Dynasty Minerals Ltd. to complete a literature review to summarize fish and fish habitat restoration projects in British Columbia (BC) and provide an overview of their benefits to fish populations, in particular salmonids. The following sections discuss the history of Fish Habitat Restoration in BC (Section 2), BC and Federal Policy on restoration projects (Section 3), and a summary of the major restoration techniques used in BC and their benefits to salmonid production (Section 4). This letter concludes with a summary of factors driving successful fish and fish habitat restoration and enhancement projects (Section 5).

ECOFISH RESEARCH

2. CONTRIBUTORS TO FISH HABITAT RESTORATION IN BC

2.1. Salmon Enhancement Program

The practice of fish habitat restoration began in earnest in BC in 1977 with the creation of the Salmon Enhancement Program (SEP). Launched by Fisheries and Oceans Canada in partnership with the BC Ministry of Environment, SEP was one of the earliest programs to invest heavily in fish habitat restoration. SEP primary activities include hatcheries, spawning channels, fertilization programs and a range of smaller scale habitat restoration projects through its Community Involvement Program (CIP). The CIP projects involve restoring and improving fish habitat such as building side channels, improving water flows, stabilizing stream banks, rebuilding estuary mashes, removing barriers to fish migration and planting streamside vegetation. CIP was able to harness the vast stakeholder interest throughout BC in salmon conservation and as a result of the program a number complimentary initiatives emerged including province wide school programs, Streamkeepers, bi-annual salmon volunteer conferences, publications and public advisory boards on fisheries issues.

CIP projects often do not involve detailed monitoring of salmon productivity and thus there is often limited quantitative information to evaluate project success. Nevertheless, by the early 1990s there was already a database of over 650 community involvement efforts (Hilborn and Winton 1993). After 35 years, this program is still in operation, and, based on qualitative assessment, has achieved significant success in improving habitat and increasing local populations of salmon. The success and longevity of SEP is based on the partnership between the federal and provincial government, First Nations, communities, groups and individuals.

2.2. Watershed Restoration Program

Another early program in BC that invested in stream habitat rehabilitation was the Watershed Restoration Program (WRP), which was implemented in 1994 through the BC Ministry of Environment and Ministry of Forests and funded by Forest Renewal BC. This program was initiated largely because of impacts of industrial forestry on watershed function and salmonid populations, and thus was used to reverse and offset habitat losses associated with past and new forest harvesting. WRP used a range of fish habitat rehabilitation procedures. Broad categories include (with some overlap): 1) restoring fish access to habitat, 2) restoring salmon spawning habitat, 3) stream bank stabilization and restoration, 4) within-channel habitat restoration and mitigation, 5) off-channel habitat restoration and mitigation, and 6) stream fertilization (Slaney and Zaldokas 1997). From 1998 to 2001 WRP conducted 301 aquatic condition assessments, 166 aquatic and riparian restoration projects, and 52 effectiveness monitoring projects and rehabilitated over 500 km of streams (Cleary and Underhill 2001). Many of the projects have not implemented extensive monitoring programs,

however where the data is available, restoration has shown significant positive effects on salmonid populations.

As a result of these extensive efforts, several reports and technical papers have been produced that provide fish habitat restoration prescriptions and assessment protocols, such as 'Fish Habitat Rehabilitation Procedures' (Slaney and Zaldokas, 1997) and 'Riparian Assessment and Prescription Procedures' (Koning, 1999). Further, watershed-level planning and evaluation strategies for restoration have been established (Johnston and Moore 1995; Gaboury and Wong 1999). Overall, these procedures and techniques developed through the Watershed Restoration Program have provided the basis for a set of integrated restorative measures to accelerate natural recovery in watersheds impacted by a range of resource management practices (Cleary and Underhill 2001).

2.3. Funding Contributors to Fish Habitat Restoration

Considerable funding amounts have been committed to fish habitat restoration projects in BC from a variety of sources. BC Hydro Fish and Wildlife Conservation Program, Habitat Conservation Trust Fund and the Pacific Salmon Foundation are some of the major investors-to-date.

Established in 1988, BC Hydro implemented the Fish and Wildlife Compensation Program (FWCP) to compensate for the impacts to fish, wildlife and their supporting habitats affected by BC Hydro owned and operated generation facilities in all regions of BC. More than $110 million has been invested in more than 1,500 projects since 1988. A significant portion of funds are committed annually to resident and anadromous salmonid restoration projects influenced by generation facilities throughout the province.

The Habitat Conservation Trust Fund (HCTF) is a trust set up to manage a portion of annual hunting and fishing license fees, court awards, donations and other revenue sources. The funds are distributed to projects that aim to restore, maintain, or enhance native freshwater fish and wildlife populations and habitats. Since 1981, approximately $140 million has been spent in over 2000 projects across BC.

The Pacific Salmon Foundation (PSF) is an independent, non-governmental, charitable organization to protect, conserve and rebuild wild Pacific salmon populations in British Columbia and the Yukon Territory. Their funding is from a variety of sources including the sale of conservation stamps on salt water sport and commercial fishing licenses. They also generate funds through auctions, fundraising dinners, events and charitable contributions as well as through partnership initiatives with government, First Nations, industry and volunteers. Since its inception in 1987, PSF has funded 1185 projects with a total value of $64 million dollars for salmon.

ECOFISH RESEARCH

3. PROVINCIAL AND FEDERAL POLICY ON RESTORATION

3.1. Provincial Policy

BC Ministry of Environment has recently released an Environmental Mitigation Policy (MOE 2014). This policy defines a mitigation hierarchy where avoiding and minimizing impacts are higher priority than restoration and offsetting the potential impacts on environmental values. Offsetting is based on ecological equivalency (i.e., the similarity between the environmental values that will be impacted and the offset that would make up for the impact), with this principle guiding the type and amount of offsetting. Calculating an offset amount (area-based or financial) is based on the consideration of "true costs" to undertake similar action(s) if they were completed by the proponent (e.g., market values, cost of restoration, cost of land securement, etc.).

Offsetting is the responsibility of the person whose project or activity impacts environmental values. The offset must be "additive" (i.e., incremental to activities already planned or underway), and should first consider like-for-like and on-site or in-proximity offsetting. "Trading up" or like-for-better, may be supported in circumstances where there are defensible reasons that a like-for-like offset would clearly not deliver the same conservation benefits. The authorizing decision maker will determine if an offset is acceptable based on provincial staff advice, and if the offsetting measures can be considered as mitigation within the authorizing legislation. Offsetting may be offered as part of a mitigation plan voluntarily at any time.

3.2. Federal Policy

To counter the adverse impacts that development activities may have on fish habitat, the government of Canada amended Canada's *Fisheries Act* in 1976 to include physical habitat protection provisions that prohibit the harmful alteration, disruption, and destruction of fish habitat. In 1986, DFO implemented a Policy for the Management of Fish Habitat (the Habitat Policy) to support the physical habitat provisions of the Fisheries Act: with a stated goal to increase the long-term productive capacity of fish habitats in Canada. To achieve this conservation goal, DFO applies the Habitat Policy's guiding principle of no net loss (NNL) when proposed development projects have the potential to result in a net loss of the productive capacity of fish habitat. The development project proponent is typically required to create or restore habitat to compensate for the losses according to DFO's hierarchy of preferences, which includes a range of compensation options from the most preferred option of creating or restoring like habitat at or near the development site to the least preferred option of artificial propagation (Harper and Quigley 2005a). Furthermore the proponent is typically required to conduct follow up monitoring to assess the effectiveness of the compensation measures taken to conserve the productive capacity of fish habitat.

More recently, with changes to the *Fisheries Act* enforced in 2012, the Habitat Policy has been replaced with the Fisheries Protection Policy. Similar to the BC MOE Environmental Mitigation

Policy, the primary principle in Fisheries Protection Policy is to avoid impacts where possible. The new Fisheries Protection Policy promotes decisions based on scientific, technical and traditional knowledge, a collaborative approach, employing approved standards in an ecosystem context which considers "cumulative effects on the state, resiliency and natural biodiversity of the ecosystem".

4. TYPES OF RESTORATION PROJECTS AND EFFICACY OF TECHNIQUES FOR FISH POPULATIONS

The main factors that affect rearing and spawning success of salmonids in freshwaters are well known and are based on significant work on this topic (e.g., Keeley and Slaney 1996; Sharma and Hilborn 2001; Braun and Reynolds 2011). These are: a) habitat area, including water depth, stream width or lake size, or more simply, the amount of suitable habitat available; b) habitat complexity, including features such as large woody debris, pools, undercut banks, overhanging vegetation, and off-channel and overwintering habitat; c) water quality, such as temperature, pH, dissolved oxygen, turbidity, conductivity, nutrients and contaminants; d) water velocity, and flow variability, which affects channel structure and stability; e) substrate composition and size, which affects spawning success; and f) biotic productivity across the freshwater food web, which produces food for rearing fish. In the sections below, we review literature on aquatic restoration techniques commonly and successfully used in British Columbia to increase salmonid production. These include: 1) Restoring fish access to habitat, 2) Spawning channels, 3) Instream structures, 4) Off-channel habitats, and 5) Lake and stream fertilization. We conclude with a review of best practices for maximizing benefits of restoration.

4.1. Creating and Restoring Fish Access to Habitat

Existing natural barriers and human developments can prevent fish from accessing productive habitats. Natural barriers take the form of waterfalls, cascades, long stretches of confined high velocity channels, log jams, seasonal low flows, and in-channel accumulations of porous sediment. Man-made obstructions include culverts, debris barriers, dams and weirs, and altered flows that limit access because of high water velocity or low depth. Improving fish passage is one of the first priorities in habitat assessment and restoration (Slaney and Zaldokas 1997). Where large and productive fish habitats are located upstream of barriers, substantial gains in productive capacity can be achieved by improving fish access to these areas.

Both natural and man-made obstructions have been successfully mitigated to provide access to productive habitats using techniques developed over decades and proven in many settings. Perhaps the most striking successful example is fishways, which have been installed at both natural and man-made barriers to provide both upstream and downstream passage, beginning in the early 1900's. Of the many successful examples of fishways in British Columbia that have increased salmon

production by providing access to new habitat, the fishway on the Bonaparte River, a major tributary of the Thompson River in the interior of BC, stands out as particularly successful . In 1988, with financial support from HCTF, DFO and the Ministry of Environment, the Bonaparte Fishway was constructed at an impassable falls located 2.6 km upstream of the Bonaparte/Thompson confluence to allow anadromous salmon access to previously unavailable spawning habitat (Morris 2002). This fishway now passes Steelhead, Rainbow Trout, Chinook, and Pink Salmon, as well as Interior Fraser Coho Salmon listed as "endangered" by The Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2002). An estimated 250 to 1300 adult Steelhead and Rainbow Trout pass the fishway to spawn upstream (Morris 2002). The construction of the fishway also now supports a First Nation fishery for Chinook Salmon. For example, the ten-year mean Chinook escapement from 1990-1999 was 3,237 fish, with a maximum of 10,084 (Secwepemc Fisheries Commission 2011) (Table 1). Prior to the construction of the fishway, Chinook escapement to the Bonaparte River ranged from near zero to several hundred fish.

In 2009, the CanFishPass project was initiated in a partnership with Fisheries and Oceans Canada and Carleton University to create a searchable database containing specific information on fishways in Canada (Table 1: Hatry *et al.* 2013). The project identified 211 fishways that are primarily located along the coasts, major rivers and water bodies. British Columbia has the largest number of fishways in Canada (at minimum 62). The majority of fishways are installed to pass salmonids, although most fishways have not been adequately assessed for passage efficiency. What is known is that salmonids are more effective at passing fishways than other fish species (Noonan *et al.* 2012). In Canada, the most passed species include Rainbow/Steelhead, Atlantic Salmon, Chinook Salmon and Coho Salmon. Passage efficiency also differs between the types of fishways with pool and weir, pool and slot and natural fishways having the highest efficiencies.

4.2. Spawning Channels

Spawning channels are human-made streams that provide controlled water flow, gravel size and spawning habitat and have a history of successful operation in BC for over 50 years (Hilborn 1992; Hilborn and Winton 1993). Spawning channels are built to enhance existing production of salmon or, when needed, to compensate for degraded spawning habitat. Six spawning channels were built during the 1960s and early 1970s through the International Pacific Salmon Fisheries Commission and the Babine Lake Development Project to support Sockeye Salmon production in the Fraser Basin. These facilities have had varied efficacy, ranging from immediate and dramatic success in the case of the Weaver Creek spawning channel to significant increases in production after a 12-year adaptation period (Babine Lake channels) to limited additions to production (Nadina and Gates Creeks) (Table 1: Hilborn 1992; Hilborn and Winton 1993). The relatively poor success of the Nadina and Gates spawning channels is likely due to unforeseen environmental controls to local Sockeye production, including low juvenile survivorship and low rearing lake productivity. In the

case of the Weaver Creek spawning channel, the Sockeye run size today is more than 200 times the run size prior to channel construction in 1965. Later spawning channels such as Big and Little Qualicum, Jones and Glendale, among others, have been operated through the Salmonid Enhancement Program to support production of Chum and Pink Salmon throughout the Province. For example, the Big and Little Qualicum spawning channels together can produce over 60 million Chum fry per year and add ~312,000 adult Chum to the local fishery (data between 1981-1989: Hilborn and Winton 1993). Overall, these channels have provided substantial additions to anadromous salmon production in British Columbia, although recent data that summarizes their specific contribution is difficult to obtain. Hilborn and Winton (1993) reviewed the early contribution of spawning channels to anadromous fisheries production in BC and found that on average over 1.2 million salmon were contributed to catch per year with a landed value of close to 15 million dollars (data from 1985-89).

Spawning channels have also been used to support production of landlocked salmonids in the BC interior. Five prominent spawning channels have been built in the Kootenay region to mitigate impacts from the construction of dams with funding from BC Hydro and from HCTF. These spawning channels were constructed starting in 1965 and continue to support local production of Kokanee Salmon. In the case of the Meadow Creek spawning channel, which was constructed in 1967 and was the world's largest at the time, it now produces between 10 - 15 million Kokanee fry annually and 250,000 spawning adults (BC Ministry of Environment 2014) (Table 1).

4.3. Instream Structures

Rearing and spawning salmonids require diverse habitats for survival and reproduction, including deep pools, cover objects and stable substrates (Keeley and Slancy 1996; Braun and Reynolds 2011). When channel structure has been degraded by natural events or by human disturbances, a range of instream habitat complexing activities have been used to improve the quality of within-channel fish habitat. In fact, in terms of overall frequency, instream structures are the most abundantly used restoration technique in BC and across North America (Roni *et al.* 2008). For example, in a review that summarizes the performance of the Watershed Restoration Program, Cleary and Underhill (2001) summarize 53 instream restoration projects that represent 552 separate structures that were installed to streams in BC in the late 1990's. In contrast, 32 off-channel and 18 fish access projects were evaluated. Further, hundreds of small community-based programs have used instream restoration techniques through the Salmonid Enhancement Program.

Substrate size provides an important determinant of salmon spawning success (Keeley and Slaney 1996). The distribution of substrates within a stream is a reflection of various hydraulic, hydrologic, geomorphic and geologic characteristics. Where degradation of spawning habitat has occurred, a common restoration technique in BC is to re-establish the conditions that provide for ideal spawning habitat. Activities to rehabilitate habitat include gravel cleaning or addition, creation of

gravel catchment structures (spawning platforms), use of full or partial spanning weirs and wing deflectors, and creation of off-channel spawning habitat. Spawning habitat restoration primarily benefits non-stream rearing salmonids, such as Chum, Pink and Sockeye salmon that spawn in high densities and depend on consistent substrate sizes for egg-to-fry survival. On average, increases in spawnable gravel area per given length of stream provide an 8.5-fold increase in Chum, Pink and Sockeye salmon densities at the scale of the local reach (Table 1: Keeley *et al.* 1996; Slaney and Zaldokas 1997).

Rearing salmonids require complex habitats for cover and feeding. The instream placement of logs, wood or boulder structures to improve rearing fish habitat is one of the most common global rehabilitation practices (Roni *et al.* 2008). Simple instream boulder structures can be used to effectively rehabilitate channel morphology including fish habitat, and are most effective in riffles as well as at the head of runs (Koning and Keeley 1997). Large woody debris (LWD) is another essential feature that provides complexity to streams. Adding LWD structures during rehabilitation tends to be most effective in simple shallow pools and glides and in small streams, and least successful in medium to larger streams, which are subject to periodic storm flows or are naturally unstable. Based on studies of effectiveness up to the mid 1990's from 15 streams in BC and the Pacific Northwest, Keeley *et al.* (1996) provide a general estimate of a 2.2-fold increase in stream-rearing anadromous salmonids and 1.9-fold increase in resident salmonids due to increases in mainstem habitat complexity (Table 1).

Watershed developments can affect stream bank erosion and subsequent channel responses through increases in total yield, intensity and timing of delivery of water, sediment and woody debris to the channel, which can also affect salmonids (Koning and Keeley 1997). Common bank stabilization techniques used in BC include planting trees and shrubs that can reduce sediment input, but also provide shade, input of organic debris, and overhanging cover for fish. Bank armouring with riprap boulders and logs also reduces sediment input and bank erosion, and if large boulders and LWD are placed instream, also provides habitat for juvenile stream rearing salmonids.

In the most comprehensive evaluation of instream structures to date, Whiteway *et al.* (2010) conducted a meta-analysis of 211 stream restoration projects aimed at restoring salmonid fish across North America (Table 1). They found a significant increase in pool area, average depth, LWD, and percent cover, as well as a decrease in riffle area, following the installation of instream structures. There was also a significant increase in salmonid density (mean effect size of 167%) and biomass (mean effect size of 162%) following the installation of structures. 73% of projects resulted in increased local salmonid densities and 87% resulted in increased biomass. Large differences were observed between species, with Rainbow Trout showing the largest increases in density and biomass as a result of in-stream habitat complexing. One caution is that most projects did not distinguish aggregation effects from population level increases (Bernhardt and Palmer 2011). Nevertheless, the

main conclusion from this review is that instream habitat complexing is common, creates better habitat, and increases abundance of salmonids (Whiteway *et al.* 2010).

4.4. Off-channel Habitats

Off-channel habitats (overwintering pools, protected alcoves, groundwater channels, stream intake channels and channel pond complexes) can provide highly productive fish habitat for certain species and life stages of salmonids, especially for Chum and Coho Salmon, but also Chinook Salmon, Steelhead, Cutthroat Trout and Dolly Varden (Koning and Keeley 1997). Where appropriate, they provide cover for rearing juvenile salmonids, some protection from peak flows, and stable overwintering habitat. In streams where the recovery of channel stability will require decades, off-channel habitat restoration and mitigation projects have been successfully undertaken to create stable groundwater or intake side channels and ponds. Because of the higher risks of structural failure in larger unstable streams, off-channel projects are one of the most common technical options employed by the Watershed Restoration Program. By 1990, about 100 of these habitats had been constructed and successfully maintained by the Resource Restoration Division of the federal Department of Fisheries and Oceans, including 40 groundwater channels, which were designed for production of Chum and Coho Salmon. Restored side-channels can produce 1.6 adult Chum Salmon per m^2. High levels of Coho smolt production have been documented from complex deep ponds and boulder lined channels resulting in on average 0.5 to 1.0 smolts per m^2 and 0.07-0.09 adults per m^2 (Table 2: Koning and Keeley 1997). The relationship between off-channel pond area and fish numbers indicates that smaller ponds produce more fish per unit area than large ponds (Keeley *et al.* 1996).

More recently, Pehl (2009) evaluated the effectiveness of 7 off-channel and 42 mainstem habitat restoration projects in the interior region of British Columbia intended to restore endangered Interior Fraser Coho Salmon (Table 1). Catch per unit effort data suggested greater salmonid utilization of restored habitats than control sites, although there was relatively low statistical power to detect differences. Salmonid abundance, particularly rearing Coho, was in most cases greater in off-channel and tributary restoration sites than mainstem sites, indicating the particular importance of restoring these side-channel and tributary sites for increasing salmonid production.

4.5. Lake and Stream Fertilization

Many streams and lakes in BC are highly infertile and the base of the food chain is phosphorus and nitrogen-limited. Declines in salmon stocks throughout Western Canada and the United States have piqued agency interest in the role of marine-derived nutrients from salmon in maintaining the productivity of anadromous salmon stocks in oligotrophic watersheds. As an alternative to natural fertilization by salmon carcasses, artificial fertilizers have been used as a technique to increase

watershed productivity, freshwater salmonid growth and survival, and, ultimately, anadromous salmon marine survival.

Lake fertilization has been used to increase the productivity of lakes containing sockeye salmon in Alaska and British Columbia since the early 1970's (Stockner and Maclsaac 1996; Bradford *et al.* 2000). This technique is based on the knowledge that sockeye salmon productivity is limited by lake productivity, which affects juvenile sockeye growth and survival. Because many sockeye lakes are highly oligotrophic, lake fertilization has proved to be a success. Lake fertilization activity in BC began in 1969 with a large-scale fertilization experiment at Great Central Lake on Vancouver Island (Hyatt *et al.* 2004). The Great Central Lake experiment was extremely successful, with sockeye salmon production increasing to more than 360,000 adult fish compared to pre-fertilization levels of less than 50,000 fish (Table 1: Hyatt and Steer 1987). The value of this project spawned the SEP Lake Enrichment Program, which began with six lakes and then grew to 17 lakes by the early 1990s. In Chilko Lake BC, Bradford *et al.* (2000) showed that mean sockeye productivity in recruits per spawner increased by 73% after lake fertilization, and fertilization increased both age 1 and age 2 smolt size. In total, from 1979 to 1988, yearly production from sockeye salmon fertilized lakes was roughly 1.2 million adult fish with an estimated average commercial catch of these fish of 820,000. At the time, this figure was 9% of the total sockeye salmon catch in BC (Hilborn and Winton 1993).

Hyatt *et al.* 2004 reviewed 24 sockeye salmon nursery lake experiments that involved whole-lake fertilization including studies in Alaska. Where data were available, they found that 21 of 21 studies showed that fertilization was associated with increased chlorophyll a concentrations, 16 of 16 showed increased zooplankton biomasses, 16 of 16 demonstrated increased average smolt weights, and 11 of 13 showed increased smolt biomasses. Studies that assess egg-to-smolt survival were rare, but all (4 of 4) showed increased survival rates with fertilization. Studies involving increased smolt-to-adult survival (i.e., marine survival) were even rarer, but all (3 of 3) showed that lake fertilization and increased smolt size were associated with increased marine survival (Hyatt *et al.* 2004).

Similar to the Lake Enhancement Program, resident and anadromous salmonids can benefit from seasonal addition of limiting nutrients to oligotrophic streams. For example, the overwinter survival of salmonids is positively correlated with the size juveniles attain by autumn, to the degree that a 1 cm increase in size of fall-fry may double their overwinter survival in the stream (Keeley and Slaney 1996). By the late 1990's, experimental whole-stream fertilization had been conducted on five streams in BC with generally positive results for resident Rainbow Trout, Steelhead and other fish species (Table 1: Slaney and Zaldokas 1997; Slaney and Ashley 1999). On the Keogh River on Vancouver Island, peak Steelhead output was 2.5 times greater during fertilization than per-fertilization years. This resulted in a 50% increase in adult Steelhead abundance, or 15 more adults per kilometre. In the Salmon River, also on Vancouver Island, the mean weights of Steelhead and Rainbow Trout Parr were increased 2 to 3-fold over a distance of 15 km (Slaney and Ashley 1999) (Table 1).

ECOFISH RESEARCH

5. FACTORS INFLUENCING SUCCESS

Aquatic habitat restoration and rehabilitation is a common practice throughout the globe to mitigate impacts from development, and has included significant investment to improve habitats for salmonids here in British Columbia and across North America. In Section 4 we highlighted that habitat restoration and rehabilitation has been successful in British Columbia, increasing the production of anadromous and resident salmonids. Monitoring studies of habitat restoration and rehabilitation has identified proven techniques; however, not all restoration projects succeed. Monitoring has identified factors limiting restoration success, in turn allowing the best techniques to be identified.

In a review of 345 studies on effectiveness of stream rehabilitation throughout North America and Europe, Roni *et al.* (2008) concluded that some techniques were proven to be effective under many circumstances for improving habitat and increasing local fish abundance, including connection of isolated habitats, rehabilitation of floodplains, and placement of instream structures. Other techniques, including riparian rehabilitation, sediment reduction methods (road improvements), dam removal, and restoration of floods, demonstrate encouraging results, however, there was limited monitoring information for these methods on physical habitat, water quality, and biota, as well as a short duration and limited scope of most published evaluations. Roni *et al.* (2008) do not summarize the effectiveness of fish access, spawning channel or fertilization projects.

Roni *et al.* (2008) were able to identify several key factors limiting the success of restoration and rehabilitation projects: water quality, water quantity, erosion, and sedimentation. These factors limited success when the physical and ecological context of the project in the broader watershed was not understood. Building on this point, implementation of any single project and its techniques without consideration of both natural limitations and anthropogenic stressors acting on aquatic habitat is unlikely to address the cause of the habitat limitation, with a corresponding poor result. For example, the implementation of physical habitat restoration through increasing habitat heterogeneity is unlikely to offset limitations imposed by stressors from impaired water quality, inadequate instream flow, barriers to habitat access, or altered inputs of organic matter or sunlight, for fish, or the invertebrates they feed upon (Palmer *et al.* 2010). This understanding of the multiple factors influencing aquatic habitat productivity, and the need to understand ecological factors prior to reconstructing physical habitat is not new. Ryder and Kerr (1989) concluded that habitat improvements had unpredictable consequences, and that restoration success required an understanding of all anthropogenic impacts, including water quality effects, and a consideration of species interactions at the watershed scale. They recommended an ecosystem level approach, putting habitat needs in a hierarchic perspective where four fundamental environmental determinants (light, heat, nutrients, and oxygen) were considered prior to assessing physical habitat. Considering that few restoration and rehabilitation projects have taken such an ecosystem level approach to planning, it is

not surprising that many projects have been unsuccessful. On the other hand, the scope for increasing the effectiveness of such projects is large.

In Canada, Harper and Quigley evaluated the effectiveness of fish habitat compensation projects in achieving the conservation goal of no net loss of productive capacity of fish habitat in two reviews (2005a,b). They found 103 compensation projects that restored 493,205 m^2 of impacted fish habitat with offset habitats totalling 1,142,648 m^2, a total compensation ratio (compensation area: impact area) of greater than 2:1, although this ratio is biased by a few large projects (Harper and Quigley 2005a). They provide a further independent review of 124 Fisheries Act authorizations and found that 75% of authorizations had compensation ratios that were greater than 1:1 (Harper and Quigley 2005b). Quigley and Harper (2006) followed up their reviews in 2005 and directly tested the effectiveness of habitat compensation projects in achieving no net loss of habitat productivity across 16 randomly selected project sites in Canada completed between 1994 and 1997. Seven sites were in British Columbia. No major differences in biomass or diversity of fish were observed in compensation habitats versus control sites, meaning for fish there was limited to no net losses of habitat productivity, and thus restoration could be deemed successful. However, if other indicators such as streamside vegetation and aquatic invertebrates are considered, 63% of projects resulted in net losses in habitat productivity, while 25% of projects achieved no net loss and 12% achieved a net gain. Quigley and Harper (2006) found compensation areas were less than required, while impacted areas were greater than required, highlighting non-compliance as a key cause of the failure to achieve no net loss. They also noted the importance of considering the lag between impact and full ecological function of compensatory habitats, and conclude that compensation ratios of greater than 2:1 should often be used, and that the ability for compensation habitats to replicate ecosystem function over the short term can be challenging. These studies provide an impetus for further improving habitat compensation approaches in response to monitoring results, and the authors noted that a third of the projects did achieve or exceed no net loss, indicating a potential to build on successes. Habitat compensation, along with project design and siting, are key elements developing projects that meet regulatory requirements.

Monitoring of habitat restoration is key to demonstrating effectiveness and informing improved approaches in future projects. Harper and Quigley 2005a highlighted the lack of baseline data and insufficient monitoring duration as an impediment to effectiveness monitoring. Further studies emphasize this mismatch between the temporal scale of monitoring and assessment versus that of system recovery (Minns 2006; Scrimgeour *et al.* 2014). Many restoration projects monitor effectiveness for only a few years. Even if restoration efforts could be reliably expected to generate ecological improvements within a decade, such time lags between implementation and ecological recovery must temper expectations that restoration efforts can quickly mitigate watershed degradation. Minns (2006) recommends a monitoring time frame of twice the project's duration to confirm no net loss of productive capacity of fish habitat.

In addition, more emphasis needs to be placed on site selection for restoration projects, as the spatial context may be one of the most important factors controlling stream restoration outcome. Restoration of a particular site may have little beneficial effect unless it addresses habitat limitation at the right location at the right time. The longitudinal geometry of streams spatially separates habitats into units of disparate quality, in which fish may congregate, or avoid, at varying times in their life history. The spatial pattern of these habitats, and temporal variation in the environmental influences driving their productivity, create a complex spatial and temporal array of habitats to which fish must sequentially use to optimize growth and survival. For example, the distribution and timing of use of critical habitats by Cutthroat Trout populations supports a view of a matrix of physical sites linked by movement (Gresswell *et al.* 2006). Similarly, understanding watershed-scale variation in juvenile Coho Salmon habitat use, survival, and growth pinpoints seasonally important habitats where restoration and mitigation efforts may be most beneficial (Ebersole *et al.* 2006). Both juvenile rearing and adult spawning habitats vary in their availability seasonally, and preferred habitats may at times be rare, provide critical refugia. A good example of the latter is the site specificity shown by spawning Bull Trout, which aggregate in key groundwater fed sites many kilometres away from adult rearing habitats (Baxter and McPhail 1999). Spatial considerations are also important for invertebrate restoration, whose success is correlated with proximity to potential sources of colonists (Sundermann *et al.* 2011).

The restoration of streams and rivers should also not be expected to offset widespread anthropogenic effects throughout a catchment (Bernhardt and Palmer 2011). The very problems that lead to stream degradation are often catchment-scale problems, induced by activities upslope from reaches on which restoration projects are targeted. An example in British Columbia can be found with the decades-long experiment at Carnation Creek that shows it is necessary to improve stability to upslope areas before restoring fish habitat in the main channel. In this watershed, ongoing effects of substantial forest harvesting continue to alter watershed function and the quality of salmonid habitat, demanding proper planning, construction, and evaluation, and follow up restoration efforts (Hartman *et al.* 1996).

In basins with heavy agricultural, urban, or suburban use, effective "restoration" should focus on treatments that reduce flow variability, protect riparian vegetation and improve connectivity (Bernhardt and Palmer 2011). In less developed basins, where hydrology and water quality are relatively unaffected, treatments can focus on restoration within the channel. Restoration is more successful where riparian zones are intact, and where upstream reaches have high habitat quality and good ecological function (Lorenz and Feld 2013). Further, restoration that mimics natural processes is more likely to be effective, than that which focusses on geomorphic structure (Bernhardt and Palmer 2011).

Restoration science is evolving quickly, with new tools that promise enhanced predictive power. Advances in the modelling of freshwater life stages of salmon (from spawning through juvenile out-

migration) at degraded and restored sites allows the elucidation of the limiting factors to freshwater salmonid production, better guiding restoration planning (Railsback *et al.* 2013). Reviews highlighting the shortcomings of past restoration approaches are nonetheless confident of improved effectiveness and predictability with our increasing understanding of ecological processes (Lake et al. 2007), and point the way ahead through logical, data-driven approaches (Palmer et al. 2010). To increase the effectiveness of a restoration treatment, Hobbs and Norton (1996) recommend a specific framework:

1. Ensure current site conditions are well understood including ecological, biological and cultural factors. Through this assessment phase, the identification of degrading factors is a critical step to ultimate success of the project.
2. Specify the restoration goals and objectives to help define the project scope and establish the parameters in which the project will be deemed successful. Through this stage it is important to engage a broad audience including industry, government agencies, First Nations, community groups, landowners and academic experts (MWALP 2002). As demonstrated above, there is considerable agency and stakeholder interest in fish habitat restoration.
3. Design the physical project based on the site conditions and goals of the program.
4. Implement the design.
5. Monitor the results of the project to ensure the goals are met and allow for an opportunity to reassess the project goals and introduce an adaptive management strategy if the project goals are not satisfied.

6. CONCLUSION

Fish and fish habitat restoration projects are common in British Columbia, with many successful examples from large, high profile programs implemented throughout the Province. The Salmon Enhancement Program, the Watershed Restoration Program, BC Hydro's Compensation Programs and the Habitat Conservation Trust Fund have implemented projects with well-documented long-term benefits to fish populations. Restoring fish access to habitat, spawning channels, instream structures, off-channel habitats, and lake and stream fertilization projects have been successful at restoring and enhancing fish habitat at many locations. However, not all restoration and enhancement efforts are successful, and there are a number of well-documented reviews of failures, particularly where site specific treatments are applied in watersheds with scale problems, or where limiting factors have not been properly studied and are poorly understood. Well-defined objectives, an ecosystem-based approach to evaluation and implementation, and an understanding of factors limiting fish populations in a whole watershed, are key to successful projects. Although the success of individual restoration projects cannot be precisely predicted, ongoing monitoring in an adaptive management framework, coupled with ongoing application of continuously refined monitoring

efforts will improve restoration outcomes. Ultimately, the most successful projects create large changes in physical habitat and mimic natural processes. When projects are planned appropriately and implemented properly, they have been proven to produce dramatic improvements for fish and fish habitat.

Ecofish Research Ltd.

Signed	*Signed*
Morgan Hocking, Ph.D.	Adam Lewis, M.Sc. R.P.Bio.
Community Ecologist/Fisheries Biologist	Fisheries Biologist/Principal

ECOFISH RESEARCH

Table 1. Summary of reviewed literature

Restoration activity	Location	Monitoring / test	Target species	Improvements reported	Reference
Restoring fish access to habitat	Bonaparte River Fishway	Monitor Chinook Salmon escapement before and after fishway installed	Chinook Salmon	Ten-year mean Chinook escapement from 1990-1999 was 3,237 fish, with a maximum of 10,081. Prior to the construction of the fishway, Chinook escapement to the Bonaparte River ranged from near zero to several hundred fish.	Morris 2002, Secwepemc Fisheries Commission 2011
	Fishways across Canada; 211 present in national database; 62 of these fishways are in BC	Identification of fishways in Canada	Fish passage, primarily salmonids	New searchable database shows 211 fishways present in Canada with 62 in BC. Majority are installed to pass salmonids around natural barriers or hydropower infrastructure Only 9% have been evaluated for full effectiveness. Rainbow/Steelhead, Atlantic Salmon, Chinook Salmon and Coho Salmon are documented passing the most fishways in Canada (all > 25)	Harty *et al.* 2013
Spawning channels	Throughout coastal B.C. and Fraser River. Examples include Weaver Creek, Babine, and Big and Little Qualicum	Egg-to-fry, fry-to-smolt and smolt-to-adult survival, production for fishery	Anadromous Salmon, including Sockeye, Chum, Pink Salmon	Weaver Creek: immediately and dramatically successful. Produced more than 200,000 Sockeye per year after first cycle of operation. The run of Sockeye today is more than 200 times the size of the run prior to [illegible] Babine Lake channels: produced between 500,000 to 625,000 Sockeye per year. Took 12 years to see benefits of production. Big and Little Qualicum: release over 60 million chum fry per year. From 1981-85 contributed an estimated 312,000 Chum adults to the fishery.	Hilborn 1992; Hilborn and Winton 1993
	All BC: data from 1985-1989	Estimate of total production from spawning channels	Sockeye and Chum Salmon	Average over 1.2 million salmon contributed to catch per year with a landed value of close to 15 million dollars	Hilborn and Winton 1993
	Interior BC. Examples include Meadow Creek, Kokanee Creek, Hill Creek, Redfish Creek and Bridge Creek	Egg-to-fry survival and adult spawning abundance	Kokanee Salmon	The Meadow Creek spawning channel was constructed in 1967, and was the world's largest at the time. Supports 250,000 spawning Kokanee Salmon and produces 10-15 million fry annually with a mean egg-to-fry survival rate of 45%.	BC Ministry of Environment 2014

ECOFISH RESEARCH

Table 1. Continued

Restoration activity	Location	Monitoring / test	Target species	Improvements reported	Reference
Instream structures	Review of 5 studies in BC and Pacific Northwest to improve spawning substrate	Pre- versus post habitat restoration, where habitat started in disturbed condition	Anadromous non-stream rearing salmonids	8.5 fold increase in Chum Salmon adult abundance per 100 m of stream 8.5 fold increase in Pink Salmon adult abundance per 100 m of stream 8.6 fold increase in Sockeye Salmon adult abundance per 100 m of stream	Keeley *et al.* 1996; Koning and Keeley; Slaney and Zaldokas 1997
	Review of 15 streams in BC and Pacific Northwest with instream structures for habitat complexing	Pre- versus post habitat restoration, where habitat started in disturbed condition	Anadromous salmonids	1.8 fold increase in Coho Salmon fry, smolts and adults per area 9.3 fold increase in Chinook Salmon fry, smolts and adults per area 1.5 fold increase in Steelhead fry per area 2.3 fold increase in Steelhead parr, smolts and adults per area	Keeley *et al.* 1996; Slaney and Zaldokas 1997; Koning and Keeley 1997
			Non-anadromous stream-rearing salmonids	1.5 fold increase in total Brook Trout and 1.4 fold increase in catchable sized Brook Trout 1.4 fold increase in total Brown Trout and 1.3 fold increase in catchable sized Brown Trout 2.3 fold increase in total Cutthroat Trout and 1.3 fold increase in catchable sized Cutthroat Trout 2.7 fold increase in total Rainbow Trout and 1.3 fold increase in catchable sized Rainbow Trout	Keeley *et al.* 1996; Slaney and Zaldokas 1997; Koning and Keeley 1997
	Meta-analysis of 211 projects installing instream structures to benefit salmonids across North America	Control versus treated sites	Salmonids and their habitat	Significant increase in pool area, average depth, large woody debris, and percent cover, as well as a decrease in riffle area, following installation of in-stream structures 73% of projects resulted in increased local salmonid densities and 87% resulted in increased biomass On average 167% increase of salmonid density and 162% increase in salmonid biomass following the installation of structures No difference in salmonid abundance or biomass among structure types Differences in effect of restoration by fish species. Greatest response observed in Rainbow Trout and smallest for Steelhead. Observed significant increase in Brown Trout, Cutthroat Trout, Coho Salmon, Atlantic Salmon and Rainbow Trout Larger salmonids benefit more than small size classes	Whiteway *et al.* 2010

ECOFISH RESEARCH

Table 1. Continued

Restoration activity	Location	Monitoring / test	Target species	Improvements reported	Reference
Off-channel habitats	100 habitats constructed by 1990 in BC. Review of data from 12 side channel projects and 18 pond projects in BC and Pacific Northwest	New off-channel habitat construction	Anadromous salmonids, particularly Coho, Chum and Steelhead	1.6 Chum Salmon adults produced per m^2 of side channel constructed 0.07 Coho Salmon adults produced per m^2 of side channel constructed 0.07 Coho Salmon adults produced per m^2 of off-channel pond habitat constructed	Keeley *et al.* 1996; Koning and Keeley; Slaney and Zaldokas 1997
	Interior BC: 42 mainstem and 7 off-channel sites within the Thompson River drainage	Comparison of restoration sites and control sites	Juvenile Coho Salmon, other salmonids	Greater catch-per-unit-effort of salmonids in restored habitats compared to control sites. High utilization of off channel and tributary restoration sites compared to mainstem sites, particularly rearing Coho Salmon Projects incorporating woody debris and rock addressed both bank stabilization and fish habitat	Pehl 2009
Lake and stream fertilization	Great Central Lake, Vancouver Island BC	Pre- versus post fertilization, experimental versus control lakes	Sockeye Salmon	5-fold increases in phytoplanton production; 9-fold increases in zooplankton stocks Egg-to-fry survival rate of Sockeye salmon increased 2.6 times Sockeye adult abundance increased to more than 360 000 fish from pre-treatment levels of under 50 000	Hyatt and Steer 1987
	Chilko Lake, part of the Fraser River watershed, interior BC	Pre- versus post fertilization	Sockeye Salmon	Mean productivity (recruits per spawner) of fertilized broods of Sockeye Salmon was 73% Nutrient additions increased the mean size of age-1 smolts by 34% and that of age-2 smolts by 58%	Bradford *et al.* 2000
	17 sockeye lakes in BC	Estimates of total production from 1979 to 1988	Sockeye Salmon	Yearly production from sockeye salmon fertilized lakes was roughly 1.2 million adult fish with an estimated average commercial catch of these fish of 820,000. At the time, this figure was 9% of the total Sockeye Salmon catch in BC	Hilborn and Winton 1993
	Whole stream fertilization from 5 streams on Vancouver Island, Lower Mainland and Northern BC	Pre- versus post fertilization, experimental versus control sites	Anadromous and resident salmonids	On the Keogh River BC, the peak Steelhead smolt output was 2.5 times greater during fertilization than during pre-fertilization years. This resulted in a 50% increase in abundance of adult Steelhead (15 more adults per km) At the Salmon River on Vancouver Island, 2 to 3 fold increases in body mass and abundance of Steelhead and Rainbow Trout were observed with fertilization At the Mesilinka River in Northern BC, increases in abundance of Arctic Grayling, Mountain Whitefish, Bull Trout and Rainbow Trout by 1.5 to 5 times with fertilization	Slaney and Ashley 1999; Slaney & Zaldokas 1997

ECOFISH RESEARCH

References

Baxter, J.S., and J.D. McPhail. 1999. The influence of redd site selection, groundwater upwelling, and over-winter incubation temperature on survival of Bull Trout (*Salvelinus confluentus*) from egg to alevin. Canadian Journal of Zoology 77: 1233–1239.

Bernhardt, E.S., and M.A. Palmer. 2011. River restoration: the fuzzy logic of repairing reaches to reverse catchment scale degredation. Ecological Applications 21: 1926-1931.

Bradford, M.J., B.J. Pyper, and K.S. Shortreed. 2000. Biological responses of sockeye salmon to the fertilization of Chilko Lake, a large lake in the interior of British Columbia. North American Journal of Fisheries Management 20: 661-671.

Braun, D.C., and J.D. Reynolds. 2011. Relationships between habitat characteristics and breeding population densities in sockeye salmon (*Oncorhynchus nerka*). Canadian Journal of Fisheries and Aquatic Sciences 68: 758-767.

Cleary, J., and D. Underhill. 2001. Annual compendium of aquatic rehabilitation projects for the Watershed Restoration Program. Ministry of Water, Land and Air Protection, Ministry of Sustainable Resource Management, and Ministry of Forests. Watershed Restoration Project No. 19.

Ebersole, J.L., P.J. Wigington Jr, J.P. Baker, M.A. Cairns, M.R. Church, B.P. Hansen, and S.G. Leibowitz. 2006. Juvenile coho salmon growth and survival across stream network seasonal habitats. Transactions of the American Fisheries Society, 135(6), 1681-1697.

Gaboury, M., and R. Wong. 1999. A framework for conducting effectiveness evaluations of watershed restoration projects. Province of British Columbia, Ministry of Environment, Lands and Parks, and Ministry of Forests. Watershed Restoration Technical Circular No. 12: 40p.

Gresswell, R.E., C.E. Torgersen, D.S. Bateman, T.J. Guy, S.R. Hendricks, and J.E.B. Wofford. 2006. A spatially explicit approach for evaluating relationships among coastal cutthroat trout, habitat, and disturbance in small Oregon streams. American Fisheries Society Symposium 48: 457-471.

Harper, D.J., and J.T. Quigley. 2005a. A comparison of the areal extent of fish habitat gains and losses associated with selected compensation projects in Canada. Fisheries 30: 18-25.

Harper, D.J., and J.T. Quigley. 2005b. No net loss of fish habitat: a review and analysis of habitat compensation in Canada. Environmental Management 36: 343-355.

Hartman, G.F., J.C. Scrivener, and M.J. Miles. 1996. Impacts of logging in Carnation Creek, a high-energy coastal stream in British Columbia, and their implication for restoring fish habitat. Canadian Journal of Fisheries and Aquatic Sciences 53: 237-251.

Hatry, C, T.R. Binder, J.D. Thiem, C.T. Hasler, K.E. Smokorowski, K.D. Clarke, C. Katopodis, and S.J. Cooke. 2013. The status of fishways in Canada: trends identified using the national CanFishPass database. Rev. Fish Biol. Fisheries 23: 271-281.

Hilborn, R. 1992. Institutional learning and spawning channels for sockeye salmon (*Oncorhynchus nerka*). Canadian Journal of Fisheries and Aquatic Sciences 49: 1126-1136.

Hilborn, R., and J. Winton. 1993. Learning to enhance salmon production: lessons from the Salmonid Enhancement Program. Canadian Journal of Fisheries and Aquatic Sciences 50: 2043-2056.

Hobbs, R.J., and D.A. Norton. 1996. Towards a conceptual framework for restoration ecology. Restoration Ecology 4(2): 93-110.

Hyatt, K.D., and G.J. Steer. 1987. Barkley Sound sockeye salmon (*Oncorhynchus nerka*): evidence for over a century of successful stock development, fisheries management, research, and enhancement effort, p. 435-457. In H.D. Smith, L. Margolis, and C.C. Wood [ed.] Sockeye salmon (*Oncorhynchus nerka*) population biology and future management. Can. Spec. Publ. Fish. Aquat. Sci. 96.

Hyatt, K.D., D.J. McQueen, K.S. Shortreed, and D.P. Rankin. 2004. Sockeye salmon (*Oncorhynchus nerka*) nursery lake fertilization: review and summary of results. Environmental Reviews 12: 133-162.

Johnston, N.T., and G.D. Moore. 1995. Guidelines for planning watershed assessment projects. Province of British Columbia, Ministry of Environment, Lands and Parks, and Ministry of Forests. Watershed Restoration Technical Circular No. 1: 52p.

Keeley, E.R., and P.A. Slaney. 1996. Quantitative measures of rearing and spawning habitat characteristics for stream-dwelling salmonids: guidelines for habitat restoration. Province of British Columbia, Ministry of Environment, Lands and Parks, and Ministry of Forests. Watershed Restoration Project Report No. 4: 29p.

Keeley, E.R., P.A. Slaney, and D. Zaldokas. 1996. Estimates of production benefits for salmonid fishes from stream restoration initiatives. Province of British Columbia, Ministry of Environment, Lands and Parks, and Ministry of Forests. Watershed Restoration Management Report No. 4: 22p.

Koning, C.W., and E.R. Keeley. 1997. Salmon biostandards for estimating production benefits of fish habitat rehabilitation techniques. Chapter 3, In: P.A. Slaney, and D. Zaldokas (Eds). Fish habitat rehabilitation procedures. Province of British Columbia, Ministry of Environment, Lands and Parks. Watershed Restoration Technical Circular No. 9.

Koning, C.W. (eds) 1999. Riparian Assessment and Prescription Procedures. Province of British Columbia, Ministry of Forests and Ministry of Environment, Lands and Parks. Watershed Restoration Technical Circular No. 6.

Lake, P.S., N. Bond, and P. Reich. 2007. Linking ecological theory with stream restoration. Freshwater Biology 52(4): 597-615.

Lorenz, A.W., and C.K. Feld. 2013. Upstream river morphology and riparian land use overrule local restoration effects on ecological status assessment. Hydrobiologia 704(1): 489-501.

Quigley, J.T., and D.J. Harper. 2006. Effectiveness of fish habitat compensation in Canada in achieving no net loss. Environmental Management 37: 351-366.

Noonan, M.J., J.W.A. Grant, and C.D. Jackson. 2012. A quantitative assessment of fish passage efficiency. Fish and Fisheries 13: 450-464.

MOE. 2014. Policy for Mitigating Impacts on Environmental Values. Environmental Mitigation Policy-Working Document. Available online at http://www.env.gov.bc.ca/emop/docs/EM_Policy_WD_20140109.pdf.

MWLAP. 2002. Ecological Restoration Guidelines for British Columbia. Biodiversity Branch of Ministry of Water, Land and Air Protection. Available online at http://www.env.gov.bc.ca/fia/documents/restorationguidelines.pdf.

Palmer, M.A., H.L. Menninger, and E. Bernhardt. 2010. River restoration, habitat heterogeneity and biodiversity: a failure of theory or practice? Freshwater Biology 55: 205-222.

Pehl, D. 2009. Juvenile salmonid utilization of selected habitat restoration projects in southern interior British Columbia. Edited by M.B. Flynn. Can. Manuscr. Rep. Fish. Aquat. Sci. 2868: vii +57p.

Railsback, S.F., M. Gard, B.C. Harvey, J.L. White, and J.K. Zimmerman. 2013. Contrast of degraded and restored stream habitat using an individual-based salmon model. North American Journal of Fisheries Management 33: 384-399.

Roni, P., K. Hanson, and T. Beechie. 2008. Global review of the physical and biological effectiveness of stream habitat rehabilitation techniques. North American Journal of Fisheries Management 28: 856-890.

Ryder, R.A., and S.R. Kerr. 1989. Environmental priorities: placing habitat in hierarchic perspective, 2–12. In Proceedings of the National Workshop on Effects of Habitat Alteration on Salmonid Stocks. Edited by C.D. Levings, L.B. Holtby, and M.A. Henderson. Can. Spec. Publ. Fish. Aquat. Sci. No. 105. pp. 2–13.

Slaney, P.A. and K.I. Ashley. 1999. Case Studies of Whole-stream Fertilization in British Columbia. Restoration of Fisheries by Enrichment of Aquatic Ecosystems. pp. 83-98, In: J.G. Stockner and G. Milbrink (Eds.). Proceedings of the International Workshop at Uppsala University, March 30 to April 1, 1998, Uppsala, Sweden. 219 pp.

Slaney, P.A. and D. Zaldokas. 1997. Fish habitat rehabilitation procedures. Watershed Restoration Program. Province of British Columbia, Ministry of Environment, Lands and Parks. Watershed Restoration Technical Circular No. 9. Vancouver, B.C.

Sundermann, A., S. Stoll, and P. Haase. 2011. River restoration success depends on the species pool of the immediate surroundings. Ecological Applications 21: 1962–1971.

Stockner, J.G., and E.A. MacIsaac. 1996. British Columbia lake enrichment programme: two decades of habitat enhancement for sockeye salmon. Regulated Rivers: Research and Management 12:547–561.

Whiteway, S.L., P.M. Biron, A. Zimmermann, O. Venter, and J.W.A. Grant. 2010. Do in-stream restoration structures enhance salmonid abundance? A meta-analysis. Canadian Journal of Fisheries and Aquatic Sciences 67: 831–841.

EXHIBIT D

Mitigation and EPA's Bristol Bay Watershed Assessment Final Assessment

23 April 2014

J.W. Buell, Ph.D. & R.E. Bailey, M.S.

Background

The U.S. Environmental Protection Agency (EPA) recently completed an ecological risk assessment (two drafts and a final) for a hypothetical mine development scenario in two watersheds tributary to larger rivers in the Bristol Bay region of Alaska. The development scenario was of EPA's own creation, but drew in part on the agency's understanding of certain elements of possible concepts for a proposed mine under investigation in the same location. EPA used many highly questionable, false, and misleading assumptions and conclusions regarding their fictional mine development and operational scenario in order to demonstrate failure and environmental impact. Problems with the agency's faulty assumptions and conclusions have been discussed in detail in other documents. One area of particular weakness in EPA's ecological risk assessment is their evaluation of the feasibility and efficacy of compensatory mitigation for potential project impacts, particularly to the aquatic environment. Weaknesses in the agency's position were pointed out in considerable detail in comments on the second draft of their assessment. As a result of faulty assumptions, which were essentially unchanged and uncorrected in the Final Assessment, the agency concluded that mitigating for their hypothetical mine included:

> *…significant challenges regarding the potential efficacy, applicability and sustainability of compensation measures proposed by commenters for use in the Bristol Bay region, raising questions as to whether sufficient compensation measures exist that could address impacts of the type and magnitude described in the Bristol Bay Assessment*.

To put EPA's conclusion in perspective, two important pieces of background perspective are needed.

In Appendix J of the final ecological risk assessment, EPA provides an overview of the mitigation requirements of the Clean Water Act. In this Appendix, EPA makes several important statements:

> *This appendix* [Appendix J] *provides an overview of Clean Water Act Section 404 compensatory mitigation requirements for unavoidable impacts to aquatic resources, and discusses an array of measures that various entities have proposed as having the potential to compensate for the unavoidable impacts to wetlands, streams, and fish identified in the Bristol Bay Assessment.*
>
> *Compensatory mitigation regulations jointly promulgated by EPA and the ACOE* [U.S. Army Corps of Engineers] *(40 CFR §§ 230.91 - 230.98 and 33 CFR §§ 332.1 - 332.8) state that "the fundamental objective of compensatory mitigation is to offset environmental losses resulting from unavoidable impacts to waters of the United States authorized by [Clean Water Act Section 404 permits issued by the ACOE]" (40 CFR Part 230.93(a)(1)).*
>
> *In determining what type of compensatory mitigation will be "environmentally preferable," the ACOE "must assess the likelihood for ecological success and sustainability, the location of the compensation site relative to the impact site and their significance within the watershed, and the costs of the compensatory mitigation project"(40 CFR Part 230.93(a)(1)).*
>
> *Compensatory mitigation can occur through four methods: aquatic resource* ***restoration****,* ***establishment****,* ***enhancement****, or in certain circumstances,* ***preservation*** *(40 CFR Part 230.93(a)(2)).*

What is significant about these statements is that EPA clearly acknowledges that: 1) mitigation for unavoidable impacts is permitted under the Clean Water Act; 2) compensatory mitigation is required to offset environmental losses; 3) it is the responsibility of the ACOE to determine if compensatory mitigation is environmentally preferable and will likely be ecologically successful and sustainable; and 4) four categories of mitigation are available to meet the objective of the Clean Water Act. EPA also notes that the public and peer reviewers suggested an array of measures that could be implemented as mitigation for unavoidable environmental losses.

However, the compensatory mitigation requirement of the Clean Water Act was ignored by EPA in its assessment. In the 1st External Review Draft, EPA claimed that their mine development scenarios were both "reasonable" and would "comply with applicable laws and regulations". During the public comment period on this draft, it was pointed out to EPA that their hypothetical mine development scenario could not be permitted under state or federal law precisely because no mitigation plan or program had been presented by EPA, in violation of law and policy.

In order to remedy this defect, EPA developed Appendix J for the 2nd External Review Draft which contained a discussion of compensatory mitigation for a large mine development in the Bristol Bay Watershed. Appendix J of the 2nd External Review Draft concludes:

> *In the context of the mine scenario, the primary challenge to both a watershed approach and on-site compensatory mitigation is the absence of existing degraded resources and watershed needs within the NFK, SFK and UTC watersheds.* ***Specifically, these three watersheds are largely unaltered by human activities, and there appear to be no sites that a mitigation project could restore or enhance to offset the magnitude of impacts expected from the mine scenarios.*** [Emphasis added].

In other words, EPA concludes that because the area is in its native condition, and not previously degraded by human activities, no mitigation opportunities exist to mitigate the expected impacts hypothesized by EPA. This position by EPA ignores decades of salmon and resident fish habitat enhancement projects in unimpaired rivers and smaller streams throughout Northern California, the Pacific Northwest, British Columbia and Alaska (see habitat improvement efficacy discussion later in this document). EPA clearly either lacked the professional expertise and familiarity with standard stream habitat enhancement techniques and the subject watersheds that would enable the agency to reach a scientifically supportable conclusion that successful and sustainable mitigation is not only possible but is routinely accomplished elsewhere, or were unwilling to do so for some unstated reason.

With reference to the comments from the public and peer reviewers, EPA states in Appendix J:

> *The public and peer review comments on the draft Bristol Bay Assessment* [1st External Review Draft] *identified an array of compensation measures that commenter's [sic] believed could potentially offset these impacts to wetlands, streams, and fish.*

However, EPA is generally dismissive of the potential mitigation measures identified in public and peer-review comments because of concerns about the efficacy of such measures and general ecological considerations. EPA also failed to identify any measures of their own that could mitigate for the impacts estimated using their analyses, again in violation of the CWA.

In the Final Assessment, based on a large volume of scientific documentation submitted during the second round of public comments, EPA greatly expanded Appendix J by adding essentially attempting to rebut comments received concerning mitigation. EPA changed their conclusion regarding mitigation from "none available" because this area is "pristine" to:

There are significant challenges regarding the potential efficacy, applicability and sustainability of compensation measures proposed by commenters for use in the Bristol Bay region, raising questions as to whether sufficient compensation measures exist that could address impacts of the type and magnitude described in the Bristol Bay Assessment.

In their rebuttal to the public comments regarding potential mitigation measures received on the 2nd External Draft, EPA also mischaracterized the applicability and efficacy of the variety of measures suggested by commenters and peer reviewers to a mine development in Southwest Alaska. A particularly egregious example is the total mischaracterization of a public comment on the need for a carefully considered and ecologically based management program for beavers in order to maintain the ecological benefits to fish production, while maintaining juvenile and adult fish access to upstream or off-channel habitats. In Appendix J of the Final Assessment, EPA incorrectly characterized this suggestion as a "beaver dam removal program" and then launched into a diatribe about the benefits of having beavers in the watershed. This was a total misrepresentation of the information and suggestion submitted to EPA.

The Benefits of Fish Habitat Restoration and Enhancement are "Settled Science"

In its recently published Final Assessment, EPA takes the position that mitigation for a mining development similar to the proposed Pebble Project, located in an area similar to that surrounding the Pebble deposit, cannot be successfully mitigated for potential impacts on fish and aquatic resources. According to EPA, the agency takes this position because it regards mitigation measures identified in public comments on the first two drafts of the assessment to be "experimental" in nature, would pose "significant challenges" regarding "applicability and sustainability" of compensation measures proposed by commenters, "raising questions" that the agency does not specify. In Appendix J of the Final Assessment, EPA spent pages of new text attempting to discredit or raise questions regarding the applicability and efficacy of a variety of mitigation techniques that are indeed applicable to the Pebble deposit area watersheds. Based on this text, one can only conclude that either EPA is not aware of the large body of scientific literature documenting the success habitat restoration and improvement programs, or they ignored this body of literature and simply attempted to cast doubt on the ability of their hypothetical mine development scenarios to be mitigated in order to support some other conclusion not based on science.

In the second public comment period, EPA was provided with a 90+ page summary review of the literature regarding the applicability and efficacy of fish habitat improvement techniques. EPA's response was to try to rebut this information. The review provided to EPA states, in part:

The habitat improvement techniques reviewed in this document reflect a distillation of those specific techniques that the authors believe are most applicable to the EPA hypothetical mine area and its setting in Southwest Alaska. Many millions of dollars have been spent and continue to be spent on habitat-based enhancement of production of salmon and other fish species in the Pacific Northwest, western Canada and Alaska, and monitoring results from a wide variety of these efforts over the last three-quarters of a century, some of which are reviewed here, attest to their effectiveness. This money is being spent by the private sector for mitigation and by the public sector for mitigation and enhancement because the approaches being funded work. The authors believe that the benefits of habitat improvement using the measures reviewed here are ***settled science*** *[emphasis added].*

In summary, there is clearly an abundance of evidence in the literature that demonstrates the linkage between habitat quality and water quality parameters/nutrients and aquatic production. That these factors were not considered by EPA in BBWA2 [2nd External Review Draft] *seriously undermines that Assessment's credibility and especially its negative conclusion about the applicability of mitigation*

measures in local watersheds (on-site) and nearby (off-site). By ignoring these demonstrably successful mitigation techniques, the credibility of the BBWA2 and its conclusions regarding mitigation opportunities are very seriously compromised, if not rendered completely invalid.

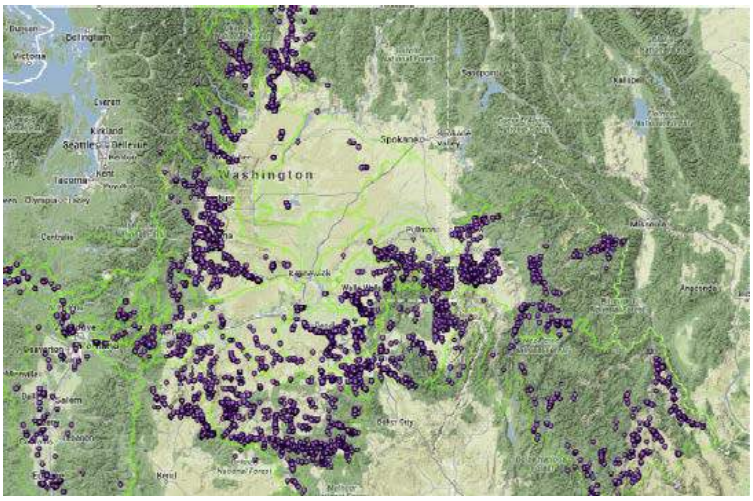
EPA utterly failed to take account of the long and largely successful record of stream habitat enhancement and rehabilitation in western North America. Stream habitat enhancement practitioners have had well over three-quarters of a century of experience with habitat manipulation, rehabilitation, enhancement, and creation in the fresh water environment in the Pacific Northwest, western Canada and Alaska (Davis et al. 1935, Silcox 1936, Tarzwell 1938, Gee 1952, Ehlers 1956, Summers and Neubauer 1956). The documentation of physical habitat enhancement and mitigation methods and intensive monitoring results demonstrating successful implementation are dominated by examples from the Pacific Northwest and Intermountain West in the United States and from British Columbia in Canada. Importantly, it was not until the early 1980s that large sums of money became available to "improve salmonid habitats" because of the collapse of salmon runs in the Eastern Pacific Ocean.

As a result of the stampede to improve anadromous and resident fish habitats, early efforts and programs targeting enhancement of salmonid habitats in small rivers and streams met with mixed results (Ehlers 1956, Buell 1982, Beschta et al. 1994). Some of the factors influencing results included inadequate project planning and misidentification of the factor(s) limiting fish production in individual cases. Habitat enhancement and rehabilitation practitioners learned rapidly from their mistakes, however. Over the past three decades, the evolution of knowledge regarding the relationships among fluvial processes, aquatic habitats and the fish they support has brought the art and science of habitat enhancement and rehabilitation to an advanced state (Hall and Baker 1982; Reeves and Roelofs 1982; National Research Council 1992; Sear 1994; Reeves et al. 1995; Slaney and Zaldokas 1997; Benda et al.1998; Saldi-Caromile et al. 2004). It is now rare to see projects implemented that have the same flaws that led to mixed success in the past.

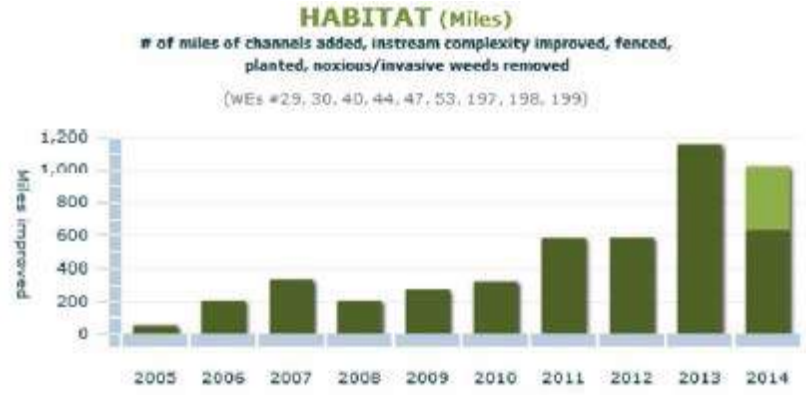
Also, EPA fails to acknowledge the success and continued implementation of a large-scale and decades-long fish habitat restoration and improvement programs by agencies, such as the Bonneville Power Administration (BPA), in the Columbia River Basin. The Columbia Basin Fish and Wildlife Program (CBFWP) constitutes the largest and most obvious example of sustained commitment by state and federal government agencies, Native American tribes and the general public to salmon and resident fish habitat mitigation and enhancement. This program was instituted in the early 1980s pursuant to the Pacific Northwest Electric Power Planning and Conservation Act (1980 Power Act; 94 Stat. 2697), and was implemented to protect, mitigate and enhance fish and wildlife, and related spawning grounds and habitat, of the Columbia River Basin that have been affected by hydroelectric development. The CBFWP includes literally thousands of detailed plans for specific fish and wildlife restoration and enhancement projects in nearly 60 sub-basins and main stem reaches of the Columbia River Basin.

The program is funded by Bonneville Power Administration through monies collected from rate-payers. Stream and riparian habitat restoration, rehabilitation and enhancement have always constituted a major portion of the program focus and commitment. Over the 30+ years since Bonneville Power Administration began tracking CBFWP revenues, total cost has been estimated by the Northwest Power and Conservation Council, which oversees the program, to be over $2.8 billion through FY 2012. The Habitat Program budget alone has generally ranged between 20% and 40% of annual Fish and Wildlife Program costs. For the 20-year funding cycle from FY 2004 through FY 2025, the allocated and projected funds for the program total $3.48 billion. Of this amount, $2.355 billion will be spent on anadromous fish and $552 million on resident fish, not counting artificial production. Broken out differently, $1.463 billion will be spent on habitat restoration, enhancement and protection, and $963 million on monitoring and evaluation of the effectiveness of mitigation/enhancement measures. For FY 2014 alone, $238 million will be spent on anadromous fish and $55 million on resident fish (not counting artificial production); $155 million will be spent on habitat

restoration, enhancement and protection and $86 million on monitoring and evaluation. Most of the *ongoing* habitat projects under this program are shown on the map below:



One of the metrics used to measure progress of the CBFWP is the number of miles of stream improved by the thousands of individual habitat measures implemented. The following graph depicts this metric for the 10 years from 2005 through 2014.



Since 2005, the CBFWP has been tracking the types and metrics of projects complete electronically. Table 1 provides a summary of completed projects by tracking metric for the period 2005 through 2013.

These funds are not spent lightly. The CBFWP is under the careful oversight of the Power and Conservation Council, and, since the funding is derived from rate-payers, there is much public scrutiny as well. In order to ensure scientific validity and efficacy, the program has additional technical oversight by the Independent Scientific Review Board (ISRB) for programmatic level review, and the Independent Scientific Review Panel (ISRP) for the review of individual measures and monitoring/evaluation results. Oversight authorities constantly adjust expenditures to ensure the best "bang for buck" outcomes, and if efficacy were a problem, continuing expenditures for ineffective measures would not be approved.

Finally, both the Power and Conservation Council and BPA encourage cost-sharing partners for individual projects or measures. Such cost-sharing reflects commitment of partners to cost-effective measures, and if outcomes were questionable or not based on science-backed and prior results-backed confidence of success, cost-share funding would have long since dried up. For example, the Grand Ronde Model Watershed Program, which focuses heavily on stream channel and riparian habitat restoration and enhancement (over 300 separate projects), 29 funding partners, of which BPA was only one, contributed over $20 million to this program over a nine year funding cycle. BPA's share was 26%. Other funding partners included 12 federal

agencies, nine state agencies, three local government agencies and four private sector groups or individuals. EPA's contribution was 0.36% of the total.

Table 1. Summary of BPA Fish and Wildlife Program Habitat Improvement Metrics 2005-2013.

				Habitat Type							
Habitat Improvement Technique	Measure Type	Unit of Measure	Total Units	Estuarine	Estuarine Wetland	Freshwater	Freshwater Wetland	Riparian	Riparian Wetland	Upland Wetland	Unspecified
Increase Instream Habitat Complexity and Stabilization	Miles of Stream with Improved Complexity	Miles	349.63								x
	Structures Installed	# Structures	6,706								x
Realign, Connect, and/or Create Channel	Acres Affected by Channel Reconnection or Addition	Acres	2.74			x					
	Acres Treated	Acres	586.54	x	x	x	x	x	x	x	
	Miles of Stream Added	Miles	46.48	x		x					x
	Miles of Stream with Improved Channel Form	Miles	44.53	x		x					
	Structures Installed	# Structures	747								x
Enhance Nutrients in Water Bodies	Pounds of Fertilizer Added	Pounds	2.89 million								x
Remove/Breach Fish Passage Barrier	Barriers Addressed	# Barriers	5			x					
	Barriers Removed	# Barriers	61	x		x					
	Miles of Habitat Accessed	Miles	236.6								x
Create, Restore, and/or Enhance Wetland	Acres Treated	Acres	4,271.55		x		x		x	x	

An individual project example of significant commitment to habitat projects within the CBFWP by funding partners is the Longley Meadow habitat restoration project. This project involved the design and creation of a new meander channel for a local salmon stream, Bear Creek, and used stream channel manipulation, placement of cover elements (boulders, root wads, etc.), riparian zone manipulation, and other techniques that have been in successful use elsewhere for many decades. Spoil from the new Bear Creek channel was used to fill the old one. BPA contributed 55% of the funding, the rest being contributed by three state agencies, the local landowner, and the Confederated Tribes of the Umatilla Indian Reservation.

The CBFWP is a very large and long-term effort to enhance, restore and protect salmon, resident fish and wildlife habitats. Internet links to the CBFWP and associated websites are listed in Appendix A.

Many other, smaller programs have also been implemented in the Pacific Northwest and British Columbia. A summary listing of selected habitat improvement projects completed in western North America using large wood elements and some with combinations of wood and boulders as example methods is presented in Table 2 below. There are many examples of evaluations of various habitat improvement projects using cover elements such as large wood and other materials in the literature. The majority of these projects show that fish production increases routinely by a factor of 2-5. Although failures have been documented, most

Table 2. Summary table listing examples of physical habitat improvements and fish production results due to those improvements.

Location	N	Type of Structure(s)	Habitat Objective Achieved	Biological Objective Achieved	Biological Monitoring		Reported Results of Improvements	Reference
					Conducted	Quality		
Western Oregon, multiple streams	395	wood, rock, gabions, combinations	Y	Y?	Some	Poor	Increased adult salmon spawning in improved areas; juvenile rearing habitats created, with some fish use noted.	Armantrout, 1991
Lolo Creek, Idaho	692	variety of designs using boulders, and wood	Y	Y	5-year evaluation	Excellent	Significant increase in age 0 Chinook and age 1+ & 2+ steelhead; no significant increase in age 0 steelhead, but high variability.	Espinosa and Lee, 1991
Lochsa River, Idaho								
Eldorado Creek	179	boulders - ~ 40% large wood - ~ 60%	Y	Y				Espinosa and Lee, 1991
Pete King Creek	185	Wood and boulder weirs (102), boulders only (83); ratio of rock to wood 1.3:1	Y	Y	5-year evaluation	Good	Significant increases in all age classes of steelhead and Chinook. Generally a four-fold increase.	Espinosa and Lee, 1991
Crooked Fork Creek	118	wood only	Y					Espinosa and Lee, 1991
White Sand Creek	76	wood only	Y					Espinosa and Lee, 1991
Squaw Creek	265	log weir/deflector - 52; root wad/boulder - 213	Y	Y	5-year evaluation	Good	Significant increases in all age classes of steelhead and Chinook.	Espinosa and Lee, 1991
Doe Creek	122	log weir/deflector - 35 root wad/boulder - 87	Y					Espinosa and Lee, 1991
Papoose Creek	375	log weir/deflector - 112; root wad/boulder - 263	Y	Y	6-year evaluation	Good	Significant increases in all age classes of steelhead, cutthroat, and Chinook.	Espinosa and Lee, 1991
Elk Creek, Oregon	200	Primarily wood with some boulders	Y	Y	5-year evaluation	Poor	Increase in coho spawning in treated reaches; adult only evaluation	Crispin et al., 1993

Table 2 (Cont'd). Summary table listing examples of physical habitat improvements and fish production results due to those improvements.

Location	N	Type of Structure(s)	Habitat Objective Achieved	Biological Objective Achieved	Biological Monitoring		Reported Results of Improvements	Reference
					Conducted	Quality		
Crooked River, Idaho		Wood and boulder weirs			Evaluation of pool use	Good	Documented preferential use of pools created by habitat improvement structures for both hatchery and wild steelhead juveniles	Thompson, 1999
Hatchery Creek, Washington	Multiple	Engineered stream with wood, boulders, alcoves, brush piles	Y	Y	Y	Good	Rearing density: +245% ; Smolt density: +(93-209)%; Egg to smolt survival: +(61-158)%; Smolt capacity: +(219-411)%; All increases compared to published values for coho salmon	Smith and Brannon, 2008
Red River, Idaho	Multiple	Combinations of wood and rock		Partially	Y	Good	Significant increases in age 1+ & 2+ steelhead in one channel type and significant decrease in another channel types	Rich et al., 1993
Western Oregon, 14 streams	812	Combinations of wood and rock	Y	Mostly	Y	Fair	13 streams had increases in juvenile densities of coho fry. Three streams had no change in age 1+ steelhead and cutthroat trout. All other streams showed increase in juvenile densities for trout fry and age 1+ steelhead and cutthroat trout	House et al. 1989
Carnation Creek, British Columbia		Woody debris			Yes	Fair	Evaluation of coho fry density as related to density of woody debris. Significant positive linear relationship between fish density and complexity of woody debris. Noted importance of wood outside the main channel as winter habitat for coho.	Forward, 1984
Brierly Brook, Nova Scotia	250 over 12 years	Digger logs	Y	Y	12 year evaluation	Adult Spawning	Significantly more Atlantic salmon redds in treated reaches than in untreated reaches.	MacInnis et al., 2008
Western Oregon, seven streams	41 constructed pools	Addition of brush bundles to constructed pools			Yes	Excellent	Significant difference in coho juveniles in pools with brush bundles added. No use of main channel constructed plunge pools. Winter alcove habitat, with complexity, highly significant.	Solazzi et al., 1999; Nickelson et al., 1992
Nechako River, British Columbia	Multiple	Woody debris bundles and debris catchers	Y	Partially	9 year evaluation	Fair	Most sampling demonstrated significant differences between improvement sites and natural sites. Improved sites appear to provide significant improvements in overwintering habitat.	Triton Environmental Consultants, 2001

occurred in the late 1970s to mid-1980s and resulted primarily from not correctly identifying the limiting factor(s) for the fish populations of interest, inadequate evaluation of the stream substrate or bank stability to prevent scour problems, inadequate maintenance in those instances where maintenance would have been appropriate, and inadequate engineering design and sizing of materials necessary to withstand flood flows (Frissell and Nawa 1992; Chapman 1995).

Both federal and state agencies have embraced stream habitat enhancement and rehabilitation methods as a part of either land management (USDI Bureau of Land Management; USDA Forest Service) or regulatory and resource management programs (Oregon Department of Fish and Wildlife; Washington Department of Fish and Wildlife; Idaho Department of Fish and Game). For example, The Washington Department of Fish and Wildlife has developed Stream Habitat Restoration Guidelines (Saldi-Caromile et al. 2004). This large compendium provides very comprehensive and detailed guidance promoting habitat-based rehabilitation and enhancement of streams targeted specifically at the production of fish, especially salmonids, with ample emphasis on secondary channel development and other methods suitable for *unimpaired and non-degraded streams and riparian areas*. Besides chronicling strategies and implementation techniques and instructions, this document stresses the documented benefits that can be reasonably expected from implementation of the approaches and techniques described. Many of the habitat enhancement and rehabilitation techniques chronicled in this compendium and successfully applied over the decades in the Pacific Northwest, British Columbia and elsewhere in Alaska are appropriate for application in settings like that surrounding the Pebble deposit.

Stream system enhancement and mitigation methods for physical salmonid habitats other than placement of cover elements and riparian zone manipulation are also available. Reconnection of abandoned channels and cut-off oxbows can add large amounts of high quality rearing, overwintering and spawning habitats. This is an especially valuable and successful method for enhancement or compensatory mitigation in stream systems that have not been degraded or impaired by past human activities. Reconnected, low water velocity habitats are especially valuable, particularly for early life stages of salmonids (fry), where existing stream reaches are dominated by relatively uniform high-velocity habitats, such as in the North Fork and South Fork Koktuli River and in parts of Upper Talarik Creek. Groundwater-fed channels and channel/pond complexes can be excavated in alluvial floodplains without relying completely on abandoned channels and cut-off oxbows. These excavated habitats provide quality habitats, especially where groundwater aquifers are close to the ground surface and/or copious channel flows can be used to provide flow to the excavated areas, such as in many reaches of the larger streams in the vicinity of the Pebble Project. In fact, EPA was provided aerial photos of such potential sites in public comments on the 2nd External Draft, which they appear to have ignored.

Chum and sockeye salmon are the species most commonly associated with secondary channel or off-channel habitats for spawning (Slaney and Zaldokas 1997) and coho for rearing and overwintering and occasionally spawning (Sheng et al. 1990). Chinook salmon juveniles often use off-channel areas for rearing and overwintering as well (Buell, 1991; Melville and McCubbing 2009). These fish appear to be attracted to secondary channels by groundwater infiltration, especially in winter when groundwater is typically warmer than water in the main channel (Bachen 1984, Sheng et al. 1990, Guillermo and Hinch 2003, Jones et al. 2003, WDFW 2004, Morley et al. 2005). Early in the history of off-channel salmon habitat development, it was found that habitat productivity could be further enhanced if additional habitat elements supplying cover (*e.g.* large woody debris, boulder clusters, coarse rock channel margins) were supplied (Lister et al. 1980, Slaney and Zaldokas 1997, WDFW 2002). Eventually, elaborate pool/channel complexes with additional habitat elements were designed and became the norm in areas where local landform could accommodate such developments.Spawning success, including egg-

to-fry survival rates has been found to be higher in developed secondary channels than main channel areas. Bustard (1986) studied relative chum egg-to-emergence survival rates for four groundwater-fed side channels, two associated with coastal (maritime) and two with interior (cold) winter areas. He reported 30-34% survival for cold winter channels and 46-60% for maritime winter channels, both rates being extremely high when compared to natural spawning areas, usually in the 5-7% range (Lister et al. 1980). A Washington Department of Fish and Wildlife study calculated chum egg-to-fry survival rates of 60.8%, 37.6% and 78.4% for three re-excavated side channels, with relatively low spawner densities, on the East Fork Satsop River, WA (WDFW 1986).

Marshall (1986) reported on chum egg-to-fry survival in two groundwater-fed spawning channels, the Worth Creek Channel in the Norrish Creek drainage near Mission, BC (Lower Fraser Valley) and the Upper Paradise Channel in the Squamish River drainage, BC. These channels were constructed in 1979 and 1982. He found survival rates of 22% for the Worth Creek Channel and 30% for the Upper Paradise channel. When results from these two channels were combined with those from five additional sites, average chum egg-to-fry survival rates were over 16%, more than twice the average reported by Lister et al. (1980) for natural spawning areas throughout British Columbia.

With the foregoing in mind, it is instructive to invoke another long-term salmon habitat enhancement program, albeit smaller that the Columbia Basin program, that has been established on the lower Cheakamus River north of Squamish, BC. Very importantly, rather than focusing on rehabilitating or repairing habitats degraded by human activities, this and other secondary channel developments elsewhere in British Columbia have focused on sites in essentially unimpaired or un-altered riverine and riparian areas. This makes these examples especially relevant to the question of mitigation for the Pebble Project or similar projects located in undisturbed areas. The highly successful multi-phased project on the Cheakamus River was started in 1982 and has been ongoing for more than 30 years, with new elements currently being planned. This program has focused on development of designed semi-natural groundwater-fed and diversion-fed secondary channels, with habitat elements strategically placed for all freshwater phases of life cycles for multiple salmon species. This complex of elements has been named the Dave Marshall Salmon Reserve after a pioneer in the development of groundwater-fed secondary channels for salmon. As of 2010, a total of ten large secondary channels had been constructed in the Salmon Reserve and subjected to intensive monitoring programs.

Early monitoring of the Upper Paradise Valley Side Channel, one of the first components of what would become the Dave Marshall Salmon Reserve, Foy (1985) determined that the carrying capacity of the channel was 3.1 coho smolts/m^2 (4.4 g/m^2 biomass). This was 5.2 times the carrying capacity (7.2 times the biomass) of natural streams of similar wetted area in the region as determined by Marshall and Britton (1980). According to monitoring data for 2000 through 2008, the main elements of this complex produced annual averages of approximately 250,000 chum fry, 60,000 pink fry, 100,000 Chinook fry, 2,000 Chinook smolts (data for 2000-2003 only), 70,000 coho smolts and 4,000 steelhead smolts (data for 2000-2003 and 2008 only; Melville and McCubbing 2009).

Other components of the David Marshall Salmon Reserve have been equally successful. The Cheakamus River Km-8 Side Channel Rewatering project was constructed in 2008 at the upper end of the Reserve. This project involved deepening, widening and bank stabilization of an ephemeral side channel of the Cheakamus River, adding boulder and large wood habitat complexing agents and installation of a small, submerged supplemental intake structure to provide sufficient flow in the channel during the start-up phase. The Km-8 Side Channel is 590 m long with an average channel wetted width of 7.4 m (ranging from 5.4 - 11.3 m; Cheakamus River discharge ~50 m3/s). The average depth in

September 2008 is 0.64 m, ranging from 0.28 m to 1.47 m. Twelve holding/rearing pools greater than 20 m^2 in size and another 15 ranging in size from 2 to 5 m^2 were excavated in the channel. One hundred eleven habitat complexing features, including 71 woody debris structures, 37 boulder clusters and two boulder riffles, were installed in the side channel at a frequency of approximately one structure per 5.1 linear meters of channel.

The 478 m-long Gorbuscha East Channel complex, developed in 2002 and 2003, involved the excavation of approximately 10,000 m^3 of alluvial material from an old channel area and installation of a headwater culvert to create 3,225 m^2 of new spawning and rearing habitat. Inflow was supplemented by upwelling throughout the deepened channel.

The Mykiss Side-Channel within the Reserve was undertaken in 2004. This project supplied year-round flow to a partially excavated 300 m-long channel, which produced approximately 2,500 m^2 of new habitat for Chinook and pink salmon and juvenile steelhead trout.

Other examples of complex of flood plain habitat developments include an area of the Chilliwack River, BC, between Chilliwack Lake and Cultus Lake in the lower Fraser River Valley. Nineteen habitat restoration projects focusing primarily on off-channel salmon habitat have been implemented. The combined efforts have restored or developed over 50,000 m^2 of secondary channel stream habitat and over 200,000 m^2 of pond habitat.

One portion of the Chilliwack River restoration program, the Centennial/Bulbeard channel and pond complex, was completed in 1998. This complex has a headworks, which supplies a controlled 1.1m^3/sec inflow from the Chilliwack River main stem. This complex incorporates development of 80,000 m^2 of pond habitat and 15,000 m^2 of stream habitat. The habitats developed provided for spawning for chum and coho salmon and rearing and overwintering for coho salmon. Monitoring during the second year after completion of the Centennial/Bulbeard complex demonstrated the production of approximately 30,325 coho smolts, most from the Bulbeard portion which contains the most pond area (Cleary 2001).

Another portion of the Chilliwack River off-channel habitat development complex is the Anderson Creek channel rehabilitation project completed in 1995. This project corrected a highway culvert passage problem and reclaimed an old meander channel for fish production at the same time. A new culvert was installed to carry part of the Anderson Creek flow to the old channel, creating a 1.5 ha pond and 200 m of inlet and outlet stream spawning and rearing habitats. Part of the old channel was deepened to provide overwintering habitat for juvenile coho and deter beaver dam construction (Foy and Logan 1997). Additionally, anadromous fish access was provided to upper Anderson Creek. Monitoring showed use of deeper areas for overwintering, good benthic invertebrate food production in the inlet and outlet streams.

These examples of successful secondary channel development for the benefit of salmon and other resident and anadromous fish species reflect the rule, not the exception. As mentioned above, the State of Washington has emphasized the importance and consistent success of this method in many areas, notably including stream systems that are substantially unimpaired by human activity.

Summary of Two Major Reviews of the Efficacy of Habitat Improvement to Fish Populations

The information presented above regarding the efficacy of individual projects/techniques was provided to EPA during the public comment periods. Instead of scientifically evaluating the information

submitted, EPA chose to prepare Appendix J attempting to rebut the efficacy of habitat improvement techniques. Two major studies have been conducted over the past decade to specifically address the efficacy of various habitat improvement techniques.

The first review was completed by the Food and Agriculture Organization (FAO) of the United Nations. This review entitled: *Habitat rehabilitation for inland fisheries: Global review of effectiveness and guidance for rehabilitation of freshwater ecosystems* (FAO Fisheries Technical Paper 484 (2005)), was completed by staff of the National Marine Fisheries Service's Northwest Fisheries Science Center and FAO staff. Two quotes summarize the findings from review of hundreds of papers worldwide:

> *This paper reviews published evaluations of freshwater habitat rehabilitation projects, including studies on roads improvements and sediment reduction, riparian and floodplain rehabilitation,* ***placement of habitat structures in lakes and streams, addition of nutrients to increase aquatic production and other less common techniques. In particular, the authors summarize what is known about the effects of various techniques for restoring natural processes, improving habitat, and increasing fish and biotic production.*** [Emphasis added].

> *Despite locating more than 330 studies on effectiveness, as well as hundreds of other papers on rehabilitation, it was difficult to draw firm conclusions about many specific techniques because of the limited information provided on physical habitat, biota and costs, as well as the short duration and scope of most published evaluations.* ***However, techniques such as reconnection of isolated habitats, rehabilitation of floodplains and placement of instream structures have proven effective for improving habitat and increasing local fish abundance under many circumstances.*** [Emphasis added].

What is important about these quotes is that the techniques generally provided to EPA in public comments and shown by this review to be effective, are the same types of techniques that have been suggested for use by public commenters and peer reviewers as compensatory mitigation for a mine development such as Pebble.

The second study, commissioned by the Bonneville Power Administration and Bureau of Reclamation to support the Endangered Species Act consultation to obtain a biological opinion for operation of the Federal Columbia River Power System, reached the same conclusions as the FAO review. This second report entitled: *Benefits of Tributary Habitat Improvement in the Columbia River Basin: Results of Research, Monitoring and Evaluation 2007-2012* (July 2013) was prepared by a group of biologists familiar with the habitat improvements and evaluations conducted in the Columbia River Basin, and included some of the authors of the FAO report. A series of quotes from this report specifically address the benefits of habitat improvement techniques in streams tributary to the Columbia River:

> *Habitat improvements for salmon and steelhead in the Columbia River Basin make up one of the largest habitat rehabilitation programs in the nation, if not the world. The program encompasses hundreds of projects across four states; numerous state, tribal and local partners; and more than $100 million in annual funding. The miles of tributary, river and stream habitat restored now exceed the combined length of the Columbia and Willamette rivers. All major fish protection and recovery plans in the basin emphasize habitat improvements to help restore fish and offset the impacts of federal dams. These include the Northwest Power and Conservation Council's (Council) Fish and Wildlife Program and the 2008/2010 Biological Opinion for the Federal Columbia River Power System that outlines protections for fish listed under the Endangered Species Act.*

*Reviews of the scientific literature and initial results of project effectiveness monitoring have identified **fish passage improvements, in-stream wood and rock structures, livestock grazing controls, connection or construction of off-channel habitat** and flow augmentation as among **the most proven forms of habitat improvements, with the most rapid responses**.* [Emphasis added]

*Site-specific and large-scale studies are now confirming the scientific basis for protecting and improving habitat to promote salmon and steelhead survival and abundance. The evidence does not come from a single study, but rather from **the increasing weight of the literature supported by a rapidly expanding body of research and data on hundreds of habitat actions throughout the Columbia Basin**.* [Emphasis added] *Research has established relationships between habitat quality and fish survival and is pinpointing those factors, such as water flows; the number, depth and proportion of pools; gravel sizes; and temperature; that most influence juvenile salmon numbers.*

This report also presents conclusions from previous reviews of effectiveness and states the following:

*One of the earlier reviews, from 1996, examined the results of habitat improvements in western states from Alaska to California from the 1970s through the 1990s. The authors pursued any studies that examined the effects of habitat enhancement on anadromous fish abundance and sought out additional unpublished data, considering only studies that included paired reference or control sites to compare to the rehabilitated reach. Following statistical analysis, the review concluded that stream restoration supports significant increases in the densities of juvenile salmon and steelhead and that **reopened or restored off-channel habitat could significantly increase the number of juvenile fish migrating to the ocean** (Keeley et al. 1996).* [Emphasis added].

*The review of eight studies of habitat improvements in 14 different streams found an average increase in juvenile salmonid density of 123 percent, although with considerable variation at different sites and among species. The studies measured the response of steelhead as well as Chinook and coho salmon. Although the results for Chinook were not statistically significant, the authors attributed that to a dearth of data rather than lack of benefits. They noted that **post-rehabilitation fish densities were always greater than those prior to habitat projects in the studies assessed**.* [Emphasis added] *Although the studied projects included coastal streams not directly comparable to interior habitat, the results demonstrate that well-planned habitat improvements can significantly benefit fish. The review also **concluded that benefits for juvenile fish appeared large because juvenile fish responded strongly to habitat improvements. It also found that expanded access to side channels and ponds was highly productive for salmon, with the most data available for chum and coho salmon.*** [Emphasis added]. *The review calculated that additional side channels could produce as much as 1.58 additional adult chum per square meter. Side channel access and enhancement is a key habitat improvement strategy in the BiOp [Biological Opinion]. A later statistical analysis, or meta-analysis, by Whiteway (2010) of data from 211 stream rehabilitation projects found a significant improvement in habitat attributes – pool area, average depth, large woody material, percent cover and riffle area – following in-stream habitat improvements. The analysis also found **a statistically significant 167 percent average increase in salmonid density following the improvements, although there were large differences between species. The analysis examined the effectiveness of five types of in-stream improvements including weirs, deflectors, cover structure, boulders and large woody material. The authors noted that their results generally agreed with earlier studies and that unsuccessful projects they identified may have suffered from***

ineffective study design or unexpected events such as floods that confounded results. [Emphasis added].

Research has found that habitat improvements can increase fish productivity in a range from a few percent to several times over, depending on the circumstances and scale. An early review of several studies of western streams found an average 123 percent increase in density of juvenile salmonids in rehabilitated reaches. An 2010 analysis of 211 stream rehabilitation projects found a 167 percent average increase in salmonid density following in-stream improvements, although the results varied by species. Studies of juvenile Chinook salmon from the Snake River Basin found 13 percent higher survival among fish from relatively undisturbed habitat relative to fish from recently burned or logged areas, indicating that protection of high quality habitat is an important tool in promoting fish survival. Examination of habitat improvements in the Snake River Basin documented an approximately 20 percent average increase in parr-to-smolt survival associated with large numbers of habitat actions. Taking the analysis a step further demonstrated that the benefits of habitat improvements carry through to adult fish, with more than 50 percent higher survival among adult fish that originated in areas with numerous habitat improvements compared to fish from areas with few improvements.

Reviews of the scientific literature have found that many habitat improvements, when well-planned and designed, create more favorable conditions for fish and in many cases improve fish abundance and density (Roni et al. 2008; Beechie et al. 2012). ***But several reviews also concluded that studies frequently may not capture the true benefit of improvements because of inadequate study design or lack of long term monitoring (Roni, 2008; Bayley, 2002). Insignificant results may therefore reflect ineffective research designs rather than ineffective habitat improvements***. [Emphasis added]. *Only about 10 percent of aquatic habitat improvements include follow-up monitoring (Bayley and Li, 2008) and most studies have not run long enough to clearly detect improvements in fish populations or identify the specific habitat actions responsible (Bayley, 2002).*

Two specific techniques that would be particularly applicable to compensatory mitigation program for a mine development in Southwest Alaska (*e.g.* Bristol Bay region) include in-stream structures and reconnection and creation of side channels or off stream habitats. This report states regarding these two techniques:

In-stream structures:

Addition of in-stream structures such as logs and rocks is one of the most established, widely accepted and most well-studied forms of habitat improvements. Most studies have found a positive response by juvenile salmonids and those that did not were probably hampered by their short time frame or failure to consider watershed processes.

Structures such as logs, logjams, cover structures or boulders to streams are known to help increase pool area and habitat complexity, providing refuge and supporting food production for juvenile fish. Most published studies on the effectiveness of habitat improvements have focused on this type of improvement, with many studies reporting increases in pool frequency, depth, woody debris and other habitat qualities important to fish (Crispin et al.1993; Bates et al. 1997, Binns 1999; Gerhard and Reich 2000; Roni and Quinn 2001a; Negishi and Richardson 2003; Brooks et al. 2004). While a variety of factors can affect the level of response, many in-stream structures lead to substantial improvements in physical habitat such as complexity, depth and channel conditions as well as in

retention of organic matter important to food production (Roni et al. 2008). Recent literature reviews indicate that where installed correctly, in-stream structures benefit juvenile Chinook, coho and other species and life stages that prefer pool habitats (Roni et al. 2008). Constructed logjams have been shown to be particularly beneficial for juvenile Chinook, steelhead and coho (Roni et al. 2002; Pess et al. 2012). Monitoring of logjams in the Grays River, a tributary of the lower Columbia, recorded increases in pool area, habitat complexity and fish numbers following installation. The structures have also been shown to trap organic material and boost production of aquatic insects, providing additional food for fish (Coe et al. 2006). Several studies have also found benefits for spawning Chinook salmon and steelhead (Merz and Setka 2004; 2008).

Reconnection and Improvement of Off-Channel Habitat

Reconnection and improvement of off-channel habitat may include reconnecting existing side channels or wetlands or constructing new ones. It may also include relocating levees to allow more natural stream behavior and characteristics. ***Studies indicate that side channels have untapped capacity to support salmonids and have consistently shown that salmonids quickly recolonize such newly accessible habitat*** *as they do following barrier removals.* [Emphasis added].

Reconnected floodplains, ponds, side channels and wetlands have proven effective at providing habitat for juvenile salmonids (Richards et al. 1992; Roni et al. 2002, 2006, 2008; Henning et al. 2006). Removing or modifying levees can lead to wider, more active floodplains and increased connectivity between rivers and their floodplains as a function of increased surface and subsurface flow and improved riparian and aquatic diversity (Jungwirth et al. 2002; Muhar et al. 2004; Konrad et al. 2008). This can lead to improved productivity in new or reestablished habitats that increase food resources for fish (Schemel et al. 2004; Ahearn et al. 2006). Fish rearing in such habitat often demonstrate higher growth rates (Sommer et al. 2001). ***A study of food webs on the Methow River in Washington found that anadromous salmonids that are the focus of habitat improvements faced less competition for food in side channels, which had on average 251 percent higher carrying capacity for salmonids than the main channel (Bellmore et al. 2013). The study concluded that side channels could support much larger populations of salmonids, which would benefit from actions that support natural processes that promote habitat complexity in the floodplain. Constructed ponds and side channels have been shown to provide habitat for juvenile fish and can improve overwinter survival (Lister and Bengeyfield 1998; Solazzi et al. 2000; Giannico and Hinch 2003; Roni et al. 2006).*** [Emphasis added]. *Monitoring of a constructed side channel on Duncan Creek, a tributary of the lower Columbia, showed high levels of chum egg to fry survival in the range of 50 to 85 percent and ideal spawning and incubation conditions (Hilton 2010). SRFB/OWEB* [State of Washington's Salmon Recovery Funding Board and Oregon Watershed Enhancement Board, respectively] *monitoring found rapid increases in use of two projects in the upper Columbia by Chinook salmon in the year following construction.*

CONCLUSION

EPA got it wrong when they took the position in the 2nd External Review Draft and the Final Assessment that mitigation methods, such as those discussed by commenters, are "experimental" in nature, would pose "significant challenges" regarding "applicability and sustainability" of compensation measures, or would raise (unspecified) "questions" regarding efficacy in a setting like that surrounding the Pebble deposit. The agency got it wrong again when they took the position that the proposed Pebble Project cannot be mitigated. The track record for successful mitigation of potential impacts to salmon and

resident fish species in settings like that surrounding the Pebble deposit is very long, very comprehensive and very clear. Methods are available, they are appropriate, they do work, states and federal agencies are firmly committed to implementation of these methods over a wide array of landscapes, and outcomes are demonstrable and have been demonstrated. Contrary to EPA's scientifically unsupportable position, there are myriad opportunities for implementation of these methods in streams in and around the general Pebble Project area.

Appendix A

BPA Columbia Basin Fish and Wildlife Program and Power & Conservation Council links

Col Basin F&W Program
http://www.cbfish.org/
http://www.cbfish.org/Fund.mvc/BudgetSummary/2014/Expense

NPCC Program & Amendments
http://www.nwcouncil.org/fw/program/program-2009-amendments/

App. E - Sub-basin Measures
http://www.nwcouncil.org/fw/program/program-2009-amendments/appendix-e/

BPA Integrated F&W Prog.
http://efw.bpa.gov/IntegratedFWP/

PCC - 2012 Columbia River Basin Fish and Wildlife Program Costs Assessment
http://www.nwcouncil.org/Assessments/
http://www.nwcouncil.org/Assessments/financial-Assessments/2013-04/
http://www.nwcouncil.org/media/6867139/2013-04.pdf

PCC Findings, 2009 recommendations and amendments
http://www.nwcouncil.org/media/29717/2009_09F.pdf

PCC Science Rev. Panel
https://www.google.com/#q=independent+science+review+panel
http://www.nwcouncil.org/fw/isrp/

EXHIBIT E

April 28, 2014

US Environmental Protection Agency, Region 10
1200 Sixth Avenue, Suite 900
Seattle, WA
98101-3140

Attn: Dennis J. McLerran, Regional Administrator

Dear Mr. McLerran,

I am writing regarding the US Environmental Protection Agency's (EPA) final '*Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska*', dated January 2014. I am concerned that Assessment authors have cited the key findings of my work in a manner that is not fully accurate in order to bolster EPA's argument that there are "significant challenges regarding the potential efficacy, applicability and sustainability of" aquatic habitat enhancement approaches.

In the interest of candour I note that I am presently employed by a company that is related to the company advancing the Pebble Project.

Contrary to the impression left by your report, many of the aquatic habitat enhancement projects we studied as part of our work showed significant success. We found that some aquatic habitat compensation projects that are planned appropriately and implemented properly have been exceptionally successful in achieving net gains in habitat productivity. And while most of the aquatic habitat compensation projects in Canada studied did not fully achieve their enhancement objectives, this was – as the study notes – primarily due to poor planning, insufficient funding and a lack of monitoring, maintenance and regulatory oversight. It is not a reflection on the practicability of habitat enhancement approaches themselves.

In fact, what we found is that aquatic habitat compensation projects that are planned appropriately and implemented properly have been exceptionally successful in achieving net gains in habitat productivity.

For clarity, the results from our research were mixed, yet citations in EPA's Assessment give the impression that habitat compensation cannot be successful. The studies I conducted into the effectiveness of aquatic habitat enhancement projects in Canada (*Harper and Quigley* 2005*; Quigley and Harper* 2006) did not conclude these programs were an ineffective means to compensate for the unavoidable effects of development activities on aquatic habitat. Rather the research program summarized in the series of articles evaluated Canada's performance in achieving 'no net loss' of fish habitat productivity to build on successes and identify areas for improvement.

To that end, there were many projects with excellent fish habitat gains and valuable lessons. And there were others that were instructive in their illustration of opportunities to do better. Put simply, the habitat compensation projects with poor results were not a result of insurmountable problems, but in fact had simple fixes in most cases.

These mixed results provided a rich opportunity to improve the ability of regulators and proponents to design and implement habitat compensation projects. In fact, the five peer-reviewed articles and 39 recommendations flowing from our research contributed to many positive changes in Canada including new legislation[1], a new offsetting policy[2] and refined management approaches and guidance[3].

---

[1] http://www.dfo-mpo.gc.ca/pnw-ppe/changes-changements/index-eng.html
[2] http://www.dfo-mpo.gc.ca/pnw-ppe/offsetting-guide-compensation/index-eng.html
[3] http://www.dfo-mpo.gc.ca/Library/317613.pdf
[3] http://www.dfo-mpo.gc.ca/Library/347555.pdf
[3] http://www.dfo-mpo.gc.ca/Library/344519.pdf
[3] http://www.dfo-mpo.gc.ca/Library/321421.pdf

These learnings are readily transferable to other jurisdictions and can help chart a path toward greater certainty of environmental outcomes rather than corroborate the argument that habitat compensation does not work.

For instance, our research demonstrated that many compensation projects that were deemed failures would have been successful had they simply employed larger compensation ratios. While there were many habitat compensation projects (63%) that did not achieve no net loss of habitat productivity, these projects were also characterized by an average compensation ratio of just 0.7:1. It is remarkable that even 37% of projects achieved no net loss or net gains in habitat productivity when only a fraction of the impacted habitat was replaced. When compensation ratios were set at 2:1, fully 81% of projects studied achieved a net gain or no net loss in habitat productivity without any other improvements to compensation techniques or remedies to the administrative challenges observed.

Ultimately, regulators should require more than 1:1 replacement for aquatic habitat displaced by development activity – perhaps as high as 2:1. Additional ingredients for success include: a requirement for ongoing monitoring and maintenance; consideration of limiting factors and ecosystem constraints from a watershed context; and, importantly, effective regulatory oversight.

Finally, our research included representative compensation projects completed in the 1994-1997 time-frame across Canada. Both institutional approaches and compensation science have evolved significantly over the past twenty years. Aquatic habitat compensation remains a cornerstone of Canadian fisheries policy, and there are indications that rates of success continue to improve. Compensatory mitigation projects that have a stable funding source, a multi-year and even decades long commitment, strong scientific underpinnings and effective regulatory oversight – that is, a strong institutional foundation as one would expect at Pebble – have excellent prospects for success.

Sincerely,

Jason Quigley
Executive Vice President, Regulatory & Stakeholder Affairs
Hunter Dickinson Inc.

cc: Thomas C Collier
CEO, Pebble Limited Partnership

EXHIBIT F

1001 Pennsylvania Avenue, NW, Washington, DC 20004-2595 ▪ p 202 624-2500 ▪ f 202 628-5116

crowell moring

Richard E. Schwartz, Esq.
rschwartz@crowell.com
(202) 624-2905

January 9, 2014

By Electronic Mail and Hand Delivery

Arthur A. Elkins, Jr. (2410T)
Inspector General
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Re: Request For Investigation Concerning EPA Bristol Bay Watershed Assessment

Dear Mr. Elkins:

I am writing on behalf of Northern Dynasty Minerals Ltd., owner of the Pebble Limited Partnership, to request that the Office of the Inspector General launch an investigation into an EPA environmental risk assessment report, the veiled activities that led to it, and EPA's management of the peer review processes employed during its development. The report is scientifically indefensible and biased, and we are asking you to investigate whether it violates the Information Quality Act ("IQA") EPA's own IQA policies, and EPA's risk assessment and peer review policies.

Introduction

The report is entitled "An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska" (Second External Review Draft, April 2013) ("the Assessment"). It has become obvious that the report was written to justify a preemptive veto of a permit for a particular mining project ("the Pebble Project") in Southwest Alaska, although that project has not yet been defined nor entered the permitting process.

The activities in question include three elements:

1. Since about 2008 EPA employees have been working quietly within the Agency for an unprecedented EPA preemptive veto of the Pebble Project. They worked internally, they worked closely with outside groups that oppose the project, and they enlisted other federal agencies.

2. EPA has tried to advance this effort by preparing the report that is the focus of this request. That report was structured to support a veto of the Pebble Project.

EPA relied on studies selected for that same purpose, while ignoring more reliable information that was publicly available or was submitted to the Agency but ignored. With uncommon haste EPA completed a deeply flawed assessment report that adopted anti-project views wholesale.

3. In an attempt to validate this biased report EPA manipulated its peer review process in ways that violate its own peer review principles.

Much is at stake. The lost economic benefits from wrongfully blocking this project can be estimated.[1] Over a 25-year project life, they include: annually, some 15,000 jobs; an annual contribution to U.S. gross domestic product of some $2.54 billion; and combined federal, state, and local tax revenues averaging about $350 million annually. In southwest Alaska, where jobs are extremely scarce and the cost of living is prohibitive, Pebble will provide more than 1,000 full-time jobs with an average annual income in excess of $100,000, and will expand the tax base for the Lake & Peninsula Borough by some 700%. We believe these contributions will be life-changing for a region currently beset by high levels of unemployment, poverty, out-migration, the loss of funding for schools and other community services.

Below I will describe in detail the three elements summarized above. These are the EPA activities that we are requesting you to investigate.

I. EPA Employees Have Been Working With Outside Groups to Convince EPA to Preemptively Veto the Pebble Project.

Although EPA has consistently stated that it prepared the Assessment in response to petitions from Alaska Native groups for EPA to veto the Pebble Project, that explanation conceals the prior two years of effort by Agency employees to persuade EPA to issue a preemptive veto. Those efforts, including collaboration with outside interest groups and outreach to other agencies, are described below.

A. Beginning As Early as 2008, an EPA Employee Has Advocated a Veto

EPA announced on February 7, 2011 that it would conduct a scientific assessment of the Bristol Bay watershed "in response to concerns from federally-recognized tribes and others who petitioned the agency in 2010 to assess any potential risks to the watershed."[2] On its Web site, under the heading, "Why We're Studying the Bristol Bay Watershed," EPA states: "We launched the study in response to petitions from federally-recognized tribes and others who

[1] "The Economic and Employment Contributions of a Conceptual Pebble Mine to the Alaska and United States Economies," (IHS Inc.; May 2013).

[2] Available online at: http://yosemite.epa.gov/opa/admpress.nsf/d0cf6618525a9efb85257359003fb69d/8c1e5dd5d170ad99852578300067d3b3!OpenDocument

wrote to EPA with concerns about how large-scale mining could impact Bristol Bay fisheries."[3] In its many statements to Congress, the State of Alaska, the project proponent (Pebble Limited Partnership ("PLP")), the media and the public, the EPA has always asserted that the process began as a result of a formal written request by six tribes to initiate the 404(c) process under the Clean Water Act.

There is compelling evidence, however, that these EPA assertions about the origin of the 404(c) process are misleading. This evidence indicates that the 404(c) inquiry originated within EPA itself several years before the tribes made their formal written request. During the critical period prior to EPA's decision to undertake the Assessment, there were frequent contacts between key EPA officials and a small cadre of anti-Pebble activists working to secure EPA intervention using EPA's 404(c) veto power. Many of the EPA communications, activities and private meetings raise doubts about EPA's fairness, impartiality and objectivity in the Assessment process.

Although EPA has claimed that the Assessment was triggered by tribal petitions in May 2010, EPA employee Phillip North, who was based in Alaska, advocated for an EPA veto of the Pebble Project two years earlier, beginning at least as early as 2008. Mr. North then authored a critical portion of the Assessment.

On August 26, 2008, Mr. North emailed Patricia McGrath, EPA Region 10 mining coordinator, and said he would like to discuss the 404 issue at an August mining team meeting: "The 404 program has a major role. I would like the benefit of hearing what other EPA folks are thinking." [Ex. 1]

A year later, as plans were being laid for the annual EPA mining retreat where the Chuitna and Pebble projects would be discussed, North raised the issue again. In an August 17, 2009 email to EPA officials Michael Szerlog and Marcia Combes, North outlined the agenda which included "404 Issues – Phil" and said the meeting should include discussions about the EPA position and "appropriate action in response to our position." North wrote: "*As you know, I feel that both of these projects [Chuitna and Pebble] merit consideration of a 404C veto.* We will discuss this from a technical perspective and staff perspective at these meetings." [Ex. 2 (emphasis added)] A week later, on August 24, 2009, an EPA email confirmed that the agenda for the September 16, 2009 retreat would include North presenting 404 issues with discussions of the EPA position, action in response to the position and timelines, schedules and next steps. There was also to be discussion "about the appropriate communication to the developer and affected State/Federal Agencies." [Ex. 3]

These emails, obtained via a FOIA request, strongly suggest there is more to this story. But EPA documents produced under FOIA reveal no further references to this retreat, the 404(c) discussion, or whether EPA formulated a position and course of action as North requested. And

[3] Available online at: http://www2.epa.gov/bristolbay/why-were-studying-bristol-bay-watershed

the FOIA documents do not reflect any communications to state agencies, the developers or other Pebble stakeholders at that time.

Whatever happened behind the scenes and internally at EPA in 2009, by the beginning of 2010, *before* any petitions had been filed, the 404(c) issue had become significant enough inside the agency to warrant briefing the Administrator. Region 10 put together a 39-page PowerPoint briefing for EPA Administrator Lisa Jackson on January 13, 2010. Twice, the EPA briefing refers to the 404(c) veto power (on p. 35 and on the final page under "Future Options") although no permit application was pending and this would be first-ever pre-emptive 404(c) veto of a major development project in the 43-year history of the Clean Water Act.[4] [Ex. 4]

The formal tribal petition for 404(c) review would not be submitted for another four months, on May 21, 2010. Thus, the issue should have been no surprise to EPA even at the highest levels. In fact, the notion appears to have likely originated within EPA, with EPA's Phil North in Alaska, who may well have communicated the idea to those who would eventually file the petition.

B. EPA Has Encouraged Mine Opposition

One indication of Mr. North's eagerness to encourage outside opposition to the Pebble project appears in an email Mr. North sent shortly after the initial petition was filed. In a June 25, 2010 email to Richard King, whose Ekwok Village Council was one of the six tribes to file the initial 404(c) petition a month earlier, North told King: "Tribes have a very special role in Pebble issues because of government-to-government relations. EPA takes that very seriously. *I encourage you to develop that relationship as much as you can.* I look forward to talking with you more in the future." [Ex. 5] (emphasis added)

North communicated with other petitioners as well. Geoffrey Parker was the lawyer for anti-Pebble financial backer Robert Gillam and the six tribes filing the initial petition. In late 2009, Parker asked EPA who his point of contact at EPA should be. He was directed to John Pavitt, the project manager. [Ex. 6] [5] But it didn't take long for Parker find his way to North as a point of contact and source of information. [Ex. 7]

Two weeks after Parker filed the petition for the tribes, he sent North some related news stories. North's reply: "Thanks, Jeff. This is a strong argument for a broad approach to 404(c) . . . ." [Ex. 8]

Far from the dispassionate public servant seeking objective scientific information, Mr. North was also actively engaged with a number of those outside of EPA advocating an EPA veto. North collaborated with (among others) Peter Van Tuyn, a lawyer representing the Bristol

[4] EPA's only preemptive veto involved three virtually identical projects in Florida, located on three contiguous parcels. One of the three had not yet filed a formal Section 404 permit application.

[5] Parker signed the 404(c) request on behalf of the tribes Geoffrey Parker, but in his emails, he consistently uses Jeff Parker.

Bay Native Corp. ("BBNC") and Shoren Brown, Trout Unlimited's primary anti-Pebble activist. BBNC filed its own veto request on August 12, 2010 and sent a copy directly to North in a message that made it appear to be much more than a courtesy copy. Correspondence strongly suggests on-going communication and shared opposition to the Pebble Project. North replied to BBNC attorney Van Tuyn, "Hi Peter, We have been discussing 404(c) quite a bit internally at all levels of EPA. This letter will certainly stoke the fire. I look forward to talking with you in the near future." [Ex. 9] Absent an investigation, the degree to which these petitions were a product of collusion between EPA personnel and external environmental advocacy organizations remains unknown.

C. EPA Sought Veto Support From the U.S. Fish & Wildlife Service

North's role as a 404(c) advocate within EPA also spilled over into anti-Pebble advocacy with other federal agencies, including the U.S. Fish and Wildlife Service.

"I spoke with Phil North," U.S. Fish and Wildlife Service (FWS) biologist Phil Brna said in a September 23, 2010 FWS email on "Pebble and 404c." "He has now briefed people in EPA all the way up to the assistant administrator. *He believes EPA leaders have decided to proceed and they are just deciding when.*" [Ex. 10] (emphasis added)

North also seems to have dispatched the 404(c) advocates to carry the fight into other agencies. "He [North] is sending me contact info for the TU [Trout Unlimited] person so we can talk with them," wrote Brna.

"Phil says DC is opposed to his plan to do a year of outreach before they make a decision. He thinks they are just going to do this in accordance with the regs and as quickly as they can." Brna suggested to his colleagues that they ask Anchorage EPA chief Marcia Combes to have North brief FWS staff.

"When do you think we can schedule the first meeting? I will provide the Pebble layout showing road, port and mine as we know it. I also have a map showing 792.6 square miles of mining claims around Pebble," Brna said. "This is going to happen and it's going to get bloody. I am looking forward to it!"

Trout Unlimited's chief spokesman Shoren Brown joined the discussion in October 2010, saying that BBNC representatives and their lawyer Van Tuyn would participate in EPA briefings for FWS and their role would be to "stand up and support EPA." The target to be convinced was Geoff Haskett, the FWS Alaska Regional Director. [Ex. 11] (The record is devoid of any attempt to obtain participation of pro-Pebble stakeholders or state agency personnel.)

If FWS correspondence accurately reflects EPA's decision-making, EPA had unofficially decided on a 404(c) veto *even before* it began its watershed assessment. Ann Rappoport, Field Supervisor for the Anchorage Fish and Wildlife Field Office ("AFWFO") offered up a briefing

paper. [Ex. 12] The paper, dated October 1, 2010, was entitled, "EPA to Seek Service Support *When* They Use Section 404(c) of the Clean Water Act." [Ex. 13] (emphasis added)

In a "Summary of Likely Action," the paper states: "*The U.S. Environmental Protection Agency (EPA) is seeking Service support as they initiate a formal process to issue a determination that the waters of the U.S., including wetlands, within the potential pebble Mine action are unsuitable for the placement of fill material. This action would be conducted under the authority of Section 404(c) of the Clean Water Act (CWA)*, and would effectively prevent the project from receiving the necessary federal permits to develop a mine in the Nushagak and Kvichak watersheds." [Ex. 13] (emphasis added).

Although this FWS briefing paper was attached to an email written two weeks after the EPA announcement that it would undertake the watershed assessment, the FWS paper itself was dated more than four months *before* EPA's public announcement. The paper said, "As of last week [which would be in late September 2010], it is our understanding that EPA has tentatively decided to initiate the 404(c) process but they have not yet determined when this will occur."

AFWFO recommended that Phil North brief FWS Regional Director Geoff Haskett and National Park Service Regional Director Sue Masica. AFWFO further recommended that the Service support EPA and "provide biological information, technical assistance and recommendations when appropriate."

A series of emails in March 2011 shows some FWS managers trying to generate greater EPA-Department of Interior involvement up to the secretary level. Both FWS and the National Park Service are part of the Department of Interior. But FWS Chief of Conservation Planning Assistance Larry Bright, based in Arlington, Virginia, cautioned: "I wouldn't mention the Secretary's office at this point to anyone. If that particular move worked, it would need to be something that originated with EPA... Now if [Alaska Regional Director] Geoff [Haskett] gets religion and wants to brief all the way up the chain of command, that would be different." [Ex. 14]

D. EPA Has Held Ongoing Private Meetings with Mine Project Opponents

Among the most aggressive advocates for an EPA veto was Wayne Nastri, a former EPA Region 9 administrator, who shortly after leaving his post became a lobbyist for those "seeking a pre-emptive CWA 404(c) action with regard to the proposed Pebble Mine" as he wrote in one of his many messages to EPA officials. [Ex. 15]

Nastri's collegial messages opened EPA doors for people such as Shoren Brown, Bob Waldrop, executive director of the Bristol Bay Regional Seafood Development Association; and Rick Halford, a former state legislator.

EPA personnel did not seek balance. Rather, one-sided meetings seemed routine, based on the numerous EPA emails in which 404(c) advocates requested private meetings and calls and got what they wanted. The meetings almost always featured the same people: Shoren Brown of

Trout Unlimited; Bob Waldrop; Rick Halford; and the lawyers and lobbyists for the tribes, BBNC, Trout Unlimited, and others. There are elusive groups with no apparent legal existence, such as the so-called Bristol Bay Working Group. EPA seemed willing to accommodate these meeting requests without exception. [Ex. 16]

E. EPA Maintained a Period of Secrecy For a Trout Unlimited Advocacy Report

EPA has collaborated with activists seeking a veto from the agency. For example, on November 23, 2011, Trout Unlimited ("TU") provided EPA with an advance "embargoed" copy of its Bristol Bay report opposing the Pebble Project. TU informed EPA that the report was to be released "in the coming weeks." [Ex. 17] EPA distributed the report to its own staff, cautioning them about the embargo. In January, TU hosted a Q&A session with EPA about the report. Then, on February 8, 2012, TU released the report, 2 ½ months after giving EPA exclusive access. This process allowed TU to advocate its position within EPA without an opportunity for any response. This agreement between TU and EPA has come to light only because of the documents released as a result of PLP's FOIA request. [Ex. 18]

F. EPA Headquarters Has Also Exhibited Anti-Pebble Bias

Although anti-Pebble sentiment at EPA may have originated at EPA Region 10, it was also prevalent at headquarters in Washington. After EPA received the veto petitions in May 2010, Administrator Jackson neglected to inform PLP, the project proponent. At a meeting set up with representatives of PLP in July 2010 at the administrator's request, no mention was made of the petitions to veto the Project even though those petitions had been received by EPA months previously. Instead, PLP learned about the Petitions afterwards from the press.

In April 2011, EPA Administrator Lisa Jackson attended a fundraiser opposing the Pebble Project at the Supreme Court.[6] Lisa Jackson met with Alaska Native representatives opposed to the Pebble Project on multiple occasions, but over the course of this controversy she steadfastly refused to meet with Alaska Native representatives supportive of due process and a thorough analysis of the Pebble Project. Those Natives who opposed the preemptive 404(c) veto made numerous requests to meet with Administrator Jackson and every one of them was denied, despite those Native representatives being willing to adjust their schedules to conform with the Administrator's.

Headquarters' close relationship with project opponents continued even after Administrator Jackson was replaced by the current administrator, Gina McCarthy. On September 30, 2013, Administrator McCarthy signed a letter to PLP that was addressed to PLP's Chief Executive Officer John Shively. The letter was circulated to project opponents, however, *before* it was sent to PLP's CEO, a delay caused by the government shutdown. Although we assume that Ms. McCarthy was not herself responsible for this action, the fact that EPA officials were able to deliver the letter to project opponents during the shutdown—but not to its intended

[6] Alaska Daily News article stating that Lisa Jackson attended and spoke at an anti-Pebble Mine reception, available online at: http://www.adn.com/2011/04/10/1802762/critics-fault-retired-justice.html

recipient—is an indication of how closely other EPA officials were working with the Pebble opposition. Because the letter was addressed only to Mr. Shively, there was no apparent reason that it should have gone to the opposition at all. The contrast of EPA communications with Pebble opponents, which were frequent but never disclosed to PLP, is stark.

Nancy Stoner, the acting EPA Assistant Administrator for Water, appears to have been an active opponent of the Pebble Project. For many years Ms. Stoner had been a senior attorney at the Natural Resources Defense Council (NRDC), one of the principal environmental non-governmental organizations (ENGOs) opposing the Pebble Project. Ms. Stoner apparently attempted to circumvent the ban on meeting with her prior employer by adding others to anti-Pebble NRDC meetings. Specifically, when NRDC attorney Joel Reynolds on June 14, 2010, asked Stoner for a 404(c) meeting on behalf his tribal clients, she replied, "I am not supposed to set up meetings with NRDC staff, but can attend such a meeting if there are enough others in attendance." [Ex. 19] NRDC's role has not prevented Ms. Stoner from contact with other anti-Pebble groups and petitioners, and even leading a meeting requested by petitioners represented by Peter Van Tuyn. [Ex. 20] The degree to which Ms. Stoner has communicated with her former employer is not clear from the limited FOIA documents; nor are we in a position, without further investigation, to know about other anti-Pebble advocacy efforts. As the acting Assistant Administrator of the Office of Water, the office of EPA charged with deciding the fate of the Pebble Project (including potentially vetoing the project), Ms. Stoner's actions are particularly troubling.

G. Our Knowledge of EPA's Activities Is Limited Due to Email Redactions

There is clearly more to this story, but it is obscured by numerous inexplicable redactions in the EPA emails produced to PLP under FOIA. Most of the redactions are in emails with earlier dates. They occur in the body of the text as well as in address lines. Some of the emails featuring addressee redactions appear to be inconsequential. But when addressees' names are blotted out, one cannot know who participated in EPA communications, meeting invitations, and data dissemination.

When an entire block of names is removed from a message about a tribal conference call, one wonders whether the names were obliterated to make it impossible to see who was not invited. [Ex. 21] It appears the most redactions in addresses occur on those sent by Geoffrey Parker. Given his history of representing Robert Gillam, a financial backer for the anti-Pebble campaign, one cannot help but wonder what names are hidden. [Ex. 22] The early emails involving Jeff Parker, were plagued by redactions, whiteouts and blackouts, scattered through the address block, but also in the content. [Ex. 23, 24] But an email with no redactions whatsoever raises another question: why is EPA sending blind copies to Parker, as it did in this seemingly routine communication from EPA's Tami Fordham on 7-16-10, with bcc to Jeff Parker. [Ex. 25 (missing)] This email raises the question of whether EPA was routinely sending bcc emails to Parker and the other favored 404(c) advocates to keep them posted on internal EPA affairs. In general, the identities of persons communicating with agency officials are *not* exempt from release under FOIA (although arguably private information like home phone numbers may be).

Summary

Thus, although EPA has consistently claimed the Assessment was prepared in response to outside petitions, in fact the veto issue had been raised internally within the Agency two years before, and it grew serious enough to become the subject of a formal briefing of the Administrator four months *before* EPA received the first such petition. The significance of this information is that it belies the Agency's stance that it is acting as a neutral umpire responding to outside pressure. The pressure was coming from *inside* the Agency. The pretense of neutrality was, in fact, just a pretense.

Moreover, frequent communications with outside groups opposing the mine project (but not those favoring it), and the concerted EPA effort to enlist support from the Fish and Wildlife Service, show that Agency efforts to gather opposition to this project were not limited to the Agency itself. EPA, whose duty it is to evenhandedly apply the environmental laws, became the leader of efforts to pre-judge this project.

Finally, the heavily-redacted EPA emails clearly leave many gaps in the story about EPA's efforts. At the very least, the Inspector General should fill those gaps.

II. The Resulting Assessment Report Is Heavily Biased and Deeply Flawed.

In light of the intense efforts within EPA to veto the project, there should have been an extra effort to maintain neutrality of a report that commanded so many Agency resources. Unfortunately, the urge to proceed quickly, apparently to support a preemptive veto, resulted in an environmental risk assessment that is scientifically indefensible.

A. The Assessment Targets a Prospective Pebble Mine, Not the Watershed

Although the Assessment was commenced as a study of current and future potential impacts of development in the entire watershed on the salmon fishery (and other natural resources) in Bristol Bay, Alaska, it devolved into a critique of a single mining project. In fact, the Assessment never actually estimates impacts on the watershed – its purported purpose. As explained by David Atkins in his peer review of the initial draft Assessment: "Development of the mine as proposed would eliminate streams and wetlands in the project area permanently. The importance of this impact is not put in context of the watershed as a whole, so it is not possible to determine the magnitude of the risk to salmon." *Final Peer Review Report: External Peer Review of EPA's Draft Document, As Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska*, at 13 (Sept. 17, 2012) ("Final Peer Review Report").

Originally, EPA proposed a watershed assessment study of the nine separate river systems that collectively comprise Bristol Bay (an area of some 42,000 square miles). In planning for the Assessment, EPA proclaimed an expansive desire to "evaluate all potential

large-scale development in the [Bristol Bay] watershed, including mining."[7] EPA subsequently narrowed its study to just (a) two of these nine river systems, then (b) only to the impact of mining on those watersheds, then (c) only to the impact of a prospective Pebble Mine on those watersheds. No precedent exists for such a narrowing of this sort of study. In fact, EPA policy demands that watershed assessments should evaluate the watershed as a whole, not portions of it in isolation. The EPA Region 10 *Watershed Assessment Primer* ("Primer")[8] instructs, for example, that sub-watersheds "are not designed to be stand-alone assessment areas."[9] Furthermore, it provides that "[t]o maintain or improve water quality, we need to assess problems, develop responses, and predict changes at the watershed level."[10]

In contravention of this guidance, the Assessment disregards the broader watershed and the watershed significance of the hypothetical impacts. The Assessment is not a "watershed assessment" at all, rather the document comprises speculation about the impacts of a hypothetical Pebble Project, whose impacts are never placed in context. As peer reviewer David Atkins observed, ". . . it is not possible to determine the magnitude of the risk to salmon."

B. The Assessment Is Fundamentally Biased.

The bias in the Assessment is evident from comparing its conclusions with the body of the report: in its effort to attack the mine project, EPA made conclusions that are not supported by the body of the report itself. This discrepancy did not escape the notice of peer reviewer John D. Stednick, Ph.D., who wrote: "The conclusions of the Executive Summary are strongly worded (e.g., pages ES 13 to 24), yet the uncertainties presented later in the report make the strong conclusions tenuous. An expanded discussion of uncertainties and limitations may temper those 'conclusions.'" Final Peer Review Report at 19.

Although the evidence shows that the Pebble mine project poses no significant risk to the Bristol Bay fishery, the Assessment has been drafted to make it appear that it does. This distorted picture is achieved largely through a common advocacy device: selective omission. The most important omissions are:

1. The Assessment avoids discussion of the watershed context

The Assessment speaks of lost streams and wetlands from the mine scenario footprint, but never confronts the fact that the entire mine scenario will occupy about 1/20th of 1% of the total Bristol Bay watershed, and a similar proportion of its aquatic habitat.

---

[7] EPA Region 10, Bristol Bay: Frequently Asked Questions, available online at: http://yosemite.epa.gov/R10/ECOCOMM.NSF/Bristol+bay/faq.

[8] U.S. EPA Region 10, A Watershed Assessment Primer, EPA 910/B-94/005, Seattle, WA (1994).

[9] Primer, at 5.

[10] *Id.* at 2.

EPA states that it "launched this assessment to . . . evaluate the impacts of large-scale mining . . . on *the region's fish resources*" and yet the Assessment avoids this subject almost entirely. Assessment ES-1 (emphasis added). It never even attempts to quantify harm to the Bristol Bay fishery from the hypothetical mining scenario, apparently because (as noted above) any such harm would be so insignificant.

Peer Reviewer Dr. Dirk van Zyl of the University of British Columbia, an expert in mining and biogeochemistry, observed: "It is unclear to the reader how significant a loss of 87.5 km of streams in the Nushagak River and Kvichak River watersheds is to the overall ecosystem." *Id.* at 58. Dr. Dennis Dauble adds: "What is lacking is quantitative estimates of spawning and rearing habitat that would be lost relative to the total habitat available. Having this information would help provide perspective of overall risk to individual watersheds and the Bristol Bay watershed as a whole." *Id.* at 53.

2. The Assessment ignores scientific, publicly-available information about fish in the Pebble region

EPA ignored the most informative data about fish distribution, relative abundance, and density in the Pebble region. These data came from private sources (including project proponents) and from public sources such as the Alaska Department of Fish and Game (ADFG). Examples of the information that EPA ignored include:

- the 2005 Northern Dynasty Minerals progress report on fish resource/habitat studies which included sampling locations, fish catch and distribution data, and fish density plots
- the Environmental Baseline Document (EBD) released by the Pebble Limited Partnership in 2011 which contains site-specific, detailed information on fish distribution, relative abundance, and fish densities
- fish distribution, relative abundance, and fish density information from the ADFG and J.W. Buell and Associates, both of which are publically available and on ADFG's Freshwater Fish Inventory website
- data from fish collection permits issued by ADFG to private consultants of PLP, which is publicly available
- data and information presented at the annual agency meetings which included summary information and adult salmon population spawning escapement estimates
- information and data presented at a June 12, 2008 PLP/Agency Fish Technical Work Group meeting in Anchorage which included an overview of all the studies conducted near the Pebble deposit including specific information on fish distribution and relative abundance. At this meeting, a notebook with hundreds of pages of specific fish distribution and catch data that had been submitted to ADFG as part of their collection permit requirements for the years 2004-2007 was used as a resource in the presentation by PLP. EPA's Phil North attended this meeting but did not ask for a copy of these data.

Statements in the Assessment that such detailed information was not available are obviously false. All of these comments and examples were submitted by Pebble Limited Partnership ("PLP") and Northern Dynasty Minerals ("NDM") during the first comment period, but EPA failed to incorporate any of this information in the second draft of the Assessment. In fact, the foundational assessment documents for fish (Appendix A (anadromous fish) and Appendix B (resident fish)) did not change from one draft to another.

Such data omissions are repeated throughout the Assessment. PLP spent roughly $150 million to generate extraordinarily comprehensive environmental baseline information about the Pebble region, but only a limited amount of that information was ever incorporated into the Assessment, and virtually none of the incorporated information was used to determine the "ecological setting" or the ecological risk associated with the Assessment's (flawed) mine scenarios.

These omissions flout the common-sense principle – reiterated in EPA policy and guidance – to use the *best available* science and information. Consistent with EPA's Scientific Integrity Policy, EPA was required to "[e]nsure that the Agency's scientific work is of the highest quality, free from political interference or personal motivations."[11] In particular, those responsible for the Assessment were required to use "the best available science and supporting studies conducted in accordance with sound and objective scientific practices" and "data collected by accepted methods or best available methods."[12] Agency guidance further emphasizes "an inclusive approach" to assessing available evidence – one that requires EPA to "investigate the possible reasons for any disagreement [across different sources] rather than ignore inconvenient evidence."[13] Here, instead of making use of the wealth of relevant, high-quality information from PLP and others, EPA ignored it. Whether the Assessment's data omissions were mere oversights, a product of haste, or – at worst – a deliberate manipulation of the information, they are indefensible.

3. The Assessment omits scientific analysis of compensatory mitigation

If, after minimizing the project's impact, there would still be a net loss of salmon habitat, PLP would be *required* to compensate for it, and would have more than enough viable options to accomplish that mitigation. The Assessment suggests that compensatory mitigation of a loss of habitat is unlikely to succeed, due to the absence of suitable mitigation sites. In fact, the Pebble deposit area has many such sites, and PLP has identified habitat enhancement opportunities that

---

[11] U.S. EPA, Scientific Integrity Policy, at 3.

[12] U.S. EPA, *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by the Environmental Protection Agency* ("2002 Guidelines"), EPA/260R-02-008, at 19 (Oct. 2002); *see also, e.g.*, U.S. EPA, *Application of Watershed Ecological Risk Assessment Methods to Watershed Management*, EPA/600/R006/037F, at 3 (Mar. 2008) ("Effective risk communication must accurately translate *the best available and most useful scientific information* in a manner understandable to managers and stakeholders." (emphasis added)); U.S. EPA, *EPA Science Policy Council Handbook: Risk Characterization*, EPA 100-B-00-002, at 18 (Dec. 2000) ("Reasonableness is achieved when . . . the characterization is based on the best available scientific information.").

[13] U.S. EPA, *Guidelines for Ecological Risk Assessment*, EPA/630/R-95/002F, at 114, 115 (May 14, 1998).

could lead to a manyfold *increase* in habitat once compensatory mitigation is included in the analysis.[14]

EPA based the report on the environmental impacts of a mine project that included no environmental mitigation, although such protective measures are required by law. In Appendix J to the Assessment, EPA erroneously claims that there are no mitigation options within these three watersheds that could offset impacts associated with the Pebble project.[15] In support of these sweeping biological conclusions, EPA relies heavily on a recent article written by Thomas Yocum and Rebecca Barnard. Ms. Barnard is a lawyer representing the Bristol Bay Native Corporation in opposition to the Pebble Mine.[16] Mr. Yocum likewise is an active opponent of the Pebble Mine who recently authored anti-Pebble reports for the Bristol Bay Native Corporation and Trout Unlimited.[17]

4. The Assessment omits modern mining practices from its risk scenarios

The Assessment devises exaggerated risk scenarios that are based on a hypothetical mine of the EPA's design at the location of the Pebble deposit. EPA's creation excluded modern mine design and operating practices. Thus the analysis omits the environmental protection and mitigation measures *required* for mine permitting. As a result, the Assessment overstates the risk of virtually every aspect of the operation of the hypothetical mine on which the report is based.

Mr. North, perhaps the primary Pebble opponent within EPA, has reported in an extensive interview published online (*Redoubt Reporter*, July 17, 2013, by Jenny Neyman) that he co-authored the mine design sections of the report. He admitted that this was "one of the most contentious parts of the assessment . . . the mining scenario on which much of the determination of potential environmental harm is based." In fact, the failure to include mitigation or modern mining practices in that scenario is one of the fundamental sources of bias in the Assessment. Mr. North's bare-bones mining scenario apparently stems from his view, reported in this interview, that "really, mining companies don't use state of the art because it's too expensive, so it's really more like the state of the practice."

The entire Assessment is largely grounded in Mr. North's low expectations for new mines, but Mr. North's low expectations are unrealistic. As Dr. Dirk van Zyl, Ph.D., P.E. bluntly concluded: ". . . it is inconceivable to me that the Bristol Bay communities, the Alaska regulatory authorities as well as Federal Regulatory Authorities will not demand that the company follow

---

[14] Comments of Buell & Associates, Inc., *An Evaluation of EPA's Bristol Bay Watershed Assessment 2013 2nd Draft Assertions Regarding Fish Habitat Mitigation Measures Efficacy and Applicability*, (May 22, 2013)

[15] *Id.*, at 17.

[16] *See* Thomas G. Yocum & Rebecca L. Bernard, *Mitigation of Wetland Impacts from Large-Scale Hardrock Mining in Bristol Bay Watersheds*, 3 SEATTLE J. ENVT. L. 71 (2013) (describing Ms. Bernard as outside counsel for the Bristol Bay Native Corporation).

[17] *See id.* at 73 n.5 (referencing a report prepared by Mr. Yocum for the Bristol Bay Native Corporation and Trout Unlimited).

"best mining practices," however that is defined at the time. It is also inconceivable to me that the company will not follow "best mining practices" in the design and development of such a mine." Final Peer Review Report at 40.

The peer reviewers overwhelmingly supported Dr. Van Zyl's conclusion: a glaring flaw in the Assessment is its focus on a hypothetical mine that neither uses best mining practices nor conducts compensatory mitigation – a mine that could never be permitted. Numerous peer reviewers of the May 2012 draft commented on the Assessment's failure to evaluate a scenario that included best mining practices and mitigation. For example, peer reviewer David Atkins observed that "[T]he Assessment also does not consider alternative engineering strategies (so called "best practice" approaches) that could lessen the risk of failure and possibly the necessity for perpetual management and water treatment." Final Peer Review Report at 13. Peer reviewer Steve Buckley commented:

> There is inadequate information on, and analysis of, potential mitigation measures at the early stages of mine development, which would attempt to reduce the impacts of mining activities on fish and water quality.

Final Peer Review Report at 14. Dirk van Zyl, the reviewer with the most experience in mine engineering, commented:

> While the failure mode is adequately described, engineering and mitigation practices are not adequately described by EPA.
>
> Any mine in Bristol Bay will have to undergo a rigorous and lengthy regulatory review and permitting process. I do not know of a process that will exclude consideration of the impact of all mine facilities on the streams and wetlands in the region. Therefore, I would suggest that the full implications of "mine operations conducted according to conventional practices, including common mitigation measures, and that meet applicable criteria and standard[s]" should have been addressed in the report. . . . "When damages to wetlands are unavoidable, the Corps can require permit[t]ees to provide compensatory mitigation." It is unclear why this was not included in the evaluations.

Id. at 48. Dr. van Zyl also pointed out that "there are reasonable mitigation measures that would reduce or minimize the mining risks and impacts beyond those already described and incorporated by the EPA in the assessment. There are a host of measures that are not addressed in the assessment . . . ." *Id.* at 102.

Phyllis K. Weber Scannell, a reviewer with extensive experience in mine permitting in Alaska, described some of the measures missing from the Assessment's scenario:

> Chapter 4 provides a detailed description of a hypothetical mine design for a porphyry copper deposit in the Bristol Bay watershed. Some of the assumptions appear to be somewhat inconsistent with mines in Alaska. In particular, the descriptions of effects on stream flows from dewatering and water use do not account for recycling process water, bypassing clean water around the project, or treating and discharging collected water.

Id. at 49.

> Reviewer David A. Atkins noted the importance of mine mitigation measures:
>
> The Assessment describes what is considered to be conventional 'good' mining practice, but does not adequately describe and assess mitigation measures that could be required by the permitting and regulatory process. A thorough analysis of possible mitigation measures as employed for other mining projects and the likelihood that they could be successful in this environment would be necessary.

Id. at 99.

The peer reviewers also commented on some of the particular deficiencies of the mining scenario. For example, with respect to *culvert failures*, Phyllis K. Weber Scannell commented:

, Ph.D. – 75

> The risks to salmonid fish due to culvert failures would be minimized by implementation of permits by Alaska Department of Fish and Game (ADF&G), Habitat Division. Under A.S. 16.05.840-870, Alaska has some of the most protective laws for fish and fish habitat in the United States. Further, given the lack of specific information on road alignments, construction methods and stream crossings, it is not possible to calculate lengths of affected streams, quantify loss of fish habitats, or predict failures of culverts, side slopes, etc.

With respect to *pipeline failures*, Dr. van Zyl observed:

> The EPA Assessment does not identify or appropriately characterize the risks to salmonid fish due to pipeline failures. It only estimates the likelihoods of occurrence and the consequences.

Final Peer Review Report at 75. The chance of a tailings storage facility failure was given special prominence in the Assessment. On that subject, Dr. van Zyl noted:

> I expect that a tailings review board will also be used for the Pebble Mine and the behavior of a tailings management facility designed and operated under these conditions will be more representative of the potential failure likelihoods expected for such a

> facility. It is expected that this likelihood will be much lower than those used in the evaluations of the scenario in the EPA Assessment.

Final Peer Review Report at 84. The Assessment's poor characterization of the likelihood of such a failure drew the following comment from peer reviewer Charles Wesley Slaughter, Ph.D.:

> The probability approach outlined for potential TSF dam failure is unpersuasive. It is difficult to relate to a number like "0.00050 failures per dam year," or to the implication on p. 4-47 that one can expect a tailings dam failure only once in 10,000 to one million "dam years." *This could suggest to the casual reader that failure of the hypothesized TSF1 dam (for which one "dam year" is one year) should not be anticipated in either the time of human occupation of North America, or the span of human evolution.*

Final Peer Review Report at 62.

The other technical comments on defects of various aspects of the scenario are too lengthy to repeat here, but they are summarized on pages 16-23 of the June 28, 2013 *Comments on Second External Review Draft of "An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska" (April 2013)* prepared for Pebble Limited Partnership by Crowell & Moring LLP ("Crowell Comments") [Ex. 26]. The detailed technical comments are cited and discussed therein.[18]

4. Ignoring Important Environmental Data

PLP spent some $150 million on independent scientists from many different consulting firms who studied the Pebble project environment. Their work resulted in an extraordinarily comprehensive set of environmental baseline data concerning every important aspect of the Pebble deposit's environment. PLP made all of these data available to EPA in January 2012, but the Agency's May 2012 draft report essentially ignored it. In fact, even in EPA's second draft—published a year later (April 2013)—EPA *still* ignored these data, which are by far the best and most comprehensive available.

EPA's failure to consider and evaluate with care these data (and data from other public sources) is among the fundamental deficiencies in the Assessment. As explained by Buell & Associates, Inc., "EPA drew the wrong conclusions regarding adult salmon spawning distribution and relative ecological importance by failing to examine site specific and publicly available data on the habitat conditions, fish species distribution, and densities of juvenile salmonids found in their mine development impact areas." Comments of Buell & Associates,

---

[18] Tailings storage and operation: Knight Piésold Consulting, *Review of the Bristol Bay Assessment*, at 2 (June 28, 2013); wastewater treatment operation: Environmental Resources Management, *Comments on EPA's May 2013 Bristol Bay Assessment*, at 9 (June 28, 2013) ("ERM Comments"), Knight Piesold at 2-3; waste rock storage: Geosyntec Consultants, *Assessment of USEPA Response to Geosyntec's Comments on the Bristol May Watershed Assessment*, at 10-11 (May 22, 2013) ("Geosyntec Comments"); pipeline failures: Geosyntec Comments at 9-10; road corridor and culverts: Geosyntec Comments, Tbl. 1 at 11, 12.

Inc., *An Evaluation of EPA's Bristol Bay Watershed Assessment 2013 2nd Draft Assertions Regarding Fish Habitat Mitigation Measures Efficacy and Applicability*, at 12 (May 22, 2013) (herein "Buell & Associates"). For example, EPA concluded that salmon spawn above Frying Pan Lake in the South Fork of the Koktuli, a conclusion that is not supported by available data. *Id.* "If EPA had completed an adequate evaluation of the public sources of information, it is likely that their conclusions regarding the overall ecological significance and magnitude of potential impact would have been different. *Id.* at 14.

C. EPA Retained a Mine Opponent, Dr. Boraas, to Author an Appendix.

In addition, the Assessment's appendix on Native cultures (Appendix A) was authored by Professor Alan Boraas, who has been an open opponent of the Pebble Project since at least April 2007, when he was described as "a frequent op-ed contributor to the Anchorage Daily News. One of his targets for criticism is the Pebble copper project in southwest Alaska."[19] He presented work he was contracted by EPA to undertake for the assessment at various anti-Pebble forums. There are also questions about how the individuals he interviewed were chosen and why he chose to concentrate on communities that were known to be actively opposed to Pebble.

Summary

In addition to instances of biased conclusions, poor science, and slanted presentation far too numerous to mention, the Assessment was *structured* to produce a distorted risk picture. First, the object of the Assessment is a hypothetical mine—a fictional mine devised by Mr. North, an EPA employee devoted to obtaining a preemptive veto—that could never be permitted because it fails to incorporate modern environmental protection practices. Second, the Assessment assumes that the impacts on fish from this fictional mine cannot be mitigated—contrary to legal requirements, and totally in disregard of ample information (provided to the Agency) that fish impact mitigation has been successfully accomplished for many years and can be accomplished here. Finally, it not only avoids placing the speculative harm to fish in the context of the Bristol Bay fishery (the resource of concern), it even ignores publicly available data about fish distribution, relative abundance, and density in the Pebble region itself.

The Assessment report's flawed structure and selective use of data apparently stem from a desire to construct a justification to veto the Pebble project and to lead the public to draw the wrong conclusions about the possible impacts of Pebble on the Bristol Bay fishery. The Inspector General should investigate the report to illuminate shoddy practices and to help assure that Agency policies on the use of science are not so flagrantly disregarded in the future.

III. EPA Manipulated the Peer Review Process to Try to Validate This Flawed Report.

[19] J.P. Tangen, *Mining and the law: Rio Tinto and the Pebble project*, MINING NEWS, Vol. 12, No. 17 (Apr. 29, 2007).

Peer reviewing a scientific report should be a useful procedure. Here, however, EPA misused the peer review process in ways that contributed to the biased result.

A. EPA Selectively Peer Reviewed Anti-Pebble Reports and Used Them Although the Peer Reviewers Found Them to Be Biased and Unreliable

Following the issuance of the first External Review Draft of the Assessment, EPA engaged peer reviewers for the apparent purpose of legitimizing at least seven reports written by mine opponents that EPA intended to use in the final Assessment. EPA wrote that "[o]ther non-governmental organizations have collected data specific to the Pebble deposit site. USEPA subjected some of these documents to external peer review before incorporating this information into the assessment." Assessment at 2-3. EPA exclusively selected reports by paid mine opponents—none of them were by mine project proponents, or even by neutral authors. It does not appear that EPA was looking for unbiased science, but for support for a predetermined position.

Despite EPA repeatedly indicating that the Assessment would be conducted using "an open and transparent process," the public was not notified that these peer reviews would be taking place. EPA has never satisfactorily explained why those particular reports were selected. This peer review process was conducted completely in the dark.

PLP obtained copies of those peer review reports from EPA's website: they are so damning that their content probably is the reason why EPA described them so vaguely in the draft Assessment. The peer reviewers identified the biased nature of these reports, and their comments reveal that these reports have little scientific value. What little value they have comes from compilation of the results of studies by others, although those studies were apparently selected to support the authors' own anti-Pebble (or anti-mining) agenda. These circumstances suggest that EPA chose to use them not because of their scientific value, but because of their slant. For one study, in particular, ('Woody and Higman, 2011 – "Groundwater as Essential Salmon Habitat in Nushagak and Kvichak River Headwaters: Issues Relative to Mining"), the report describes findings from a *one-day survey* of streams in the project area. It is revealing that EPA spent time and money to Peer Review such a flimsy undertaking while wholly ignoring the tens of millions of dollars of scientific findings that PLP collected at the project site over *10 years* of effort.

The seven peer-reviewed reports are so biased that they have no place in an assessment that purports to be objective. These seven reports, the peer review comments, and the overt anti-Pebble mission of the authors are discussed in detail in the Crowell Comments at pages 32-40. [Ex. 26]

It is hardly surprising that the peer reviewers found bias in the foregoing studies. Most of the authors of the seven reports are paid opponents of the Pebble Project. The authors include

David Chambers, Stu Levit, Carol Ann Woody, Sarah O'Neal, Bretwood Higman, and Ann Maest. The Assessment also uses works by Kendra Zamzow.

David Chambers is the president of the Center for Science in Public Participation ("CSP2"), which opposes mining in general and the Pebble project specifically. Its website is located at http://www.csp2.org/. The website's project page discusses the organization's activities opposing Pebble and its involvement with others whose articles were selected by EPA for peer review. The website explains in relevant part:

> Since 2007 CSP2 has been providing technical support to a loose coalition of groups opposed to the proposed [Pebble] mine. Dave Chambers, (general mining), Kendra Zamzow, (geochemistry), and Stu Levit, (reclamation and regulatory), have provided support from CSP2. CSP2 also utilized consultants Carol Ann Woody, Ph.D., and Sarah O'Neal, M.S., from Fisheries Research and Consulting to provide support on fisheries biology, and Ann Maest, Ph.D., and Cam Wobus, Ph.D., from Stratus Consulting to provide technical support on geochemistry and hydrology. Bretwood Higman, Ph.D., from Ground Truth Trekking provided fault and seismic research.
>
> The research efforts of this technical team have led to a significant number of publications and professional presentations. Dave Chambers, and CSP2 consultant Bretwood Higman, developed a paper on the "Long Term Risks of Tailings Dam Failure" which has been presented at several professional meetings. Kendra Zamzow collected and analyzed water quality data from several sites in the area of the proposed mine "Investigations of Surface Water Quality in the Nushagak, Kvichak, and Chulitna Watersheds, Southwest Alaska, 2009-2010." Stratus Consulting has developed a state-of-the-art computer hydrologic model that is being used to develop predictions of groundwater and surface water flows, and the geochemistry of those waters, which would result from the development of the mine. Fisheries Research and Consulting has been involved in a multi-year survey to collect data on the presence of salmonids in the area, "Fish Surveys in Headwater Streams of the Nushagak and Kvichak River Drainages, Bristol Bay, Alaska, 2008 – 2010."
>
> EPA released its Draft "Bristol Bay Watershed Assessment" in May, 2012. This is a significant scientific effort to evaluate the potential impacts of the Pebble mine on the Bristol Bay ecosystem. Dave Chambers and Kendra Zamzow provided technical critiques of the Draft to EPA with recommendations for improvement. *CSP2 is also working with the Bristol Bay Native Corporation in its effort to convince EPA to invoke its power under section 404(c) of the Clean Water Act to veto the Pebble Project* because it would have an "unacceptable adverse effect" on fisheries resources in the Bristol Bay region.

CSP2, http://www.csp2.org/projects (last accessed June 24, 2013) (emphasis added). Of these authors, Mr. Higman is the most versatile: he co-authored papers both on tailings dam failures (with Mr. Chambers) and on ground water being essential salmon habitat (with Ms. Woody). The Assessment also uses works by Ann Maest, Cam Wobus, and Kendra Zamzow, all of whom helped Mr. Chambers' firm provide technical support "to a loose coalition of groups opposed to the proposed mine." In addition to being a mining opponent, Ann Maest has been seriously discredited by her own employer, Stratus Consulting.[20]

Lastly, if EPA believed it desirable that certain submissions by the public should be peer reviewed, then fairness demands that studies submitted by both proponents and opponents of the project should have been peer reviewed. PLP, the State of Alaska and several other organizations submitted such reports during the public comment period.

B. EPA Attempted to Manage the Peer Review Process to Minimize Criticism

1. The Peer Review Was Inappropriately Constrained By EPA's Arbitrary Deadlines.

The EPA's Peer Review process for the first draft watershed assessment (May 2012) should have produced an improved second draft, but it was conducted in a manner that minimized its impact. Part of the restriction was the schedule, which for this sort of document, EPA has kept extremely tight. The initial draft of the Assessment was prepared in about one year. By way of comparison, a review of all other watershed assessments undertaken by EPA shows most took significantly longer (5 – 11 years) to study much smaller land areas and less complex development issues. As part of EPA's imperative to issue the report quickly, the peer reviewers themselves commented that they needed more time to do justice to the magnitude of the assigned task. Peer Reviewer Dirk van Zyl, Ph.D., P.E., wrote:

> My comments contained above and below are based on a single review of the report, i.e. contractual time constraints were such that I could not afford a second review of the

[20] Dr. Ann Maest is a "Managing Scientist" with Stratus Consulting. On April 12, 2013, a sworn declaration was filed in a New York federal district court by Mr. Douglas Beltman, Executive Vice President of Stratus, referring to work carried out by Stratus and Dr. Ann Maest, where he declared that he has "disavow[ed] any and all findings and conclusions" in certain Stratus reports relating to alleged oil contamination in Ecuador. *Chevron Corp. v. Donziger, et al.*, Witness Statement of Douglas Beltman, at ¶ 76, S.D.N.Y. No. 1:11-cv-00691-LAK (filed April 12, 2013). Mr. Beltman disavowed the Stratus scientific work, in part, because his own public statements regarding this project were "misleading" (¶ 66), and public statements by others associated with the project (including Dr. Maest) were unsupportable. *See, e.g.*, ¶ 73 ("I have no scientific bases to believe any of the public statements referenced above to be true."); *see also id.* ¶ 22 ("I supervised the preparation by Dr. [Ann] Maest and other Stratus personnel or subcontractors of 11 of the 24 sub-reports and appendices . . . ."). For more information regarding Dr. Maest, see American Resources Policy Network, *A Response to the EPA's Release of its Revised Bristol Bay Watershed Assessment* (Apr. 29, 2013), *available at* http://americanresources.org/a-response-to-the-epas-release-of-its-revised-bristol-bay-watershed-assessment/.

> report. It is therefore possible that there are other errors remaining in the report that I did not observe in my review.

Final Peer Review Report, at 23.

EPA had no good justification for imposing such an abbreviated schedule. According to EPA's Peer Review Handbook,[21] "[t]he schedule for peer review should take into account the availability of a quality draft work product, availability of appropriate experts, time available for peer review comments, deadlines for the final work product, and logistical aspects of the peer review (e.g., contracting procedures)." Peer Review Handbook at § 3.3.1. Here, the complexity of the scientific issues, the absence of any obligatory deadlines, and the significant implications of the Assessment for future policymaking called for a generous schedule rather than the condensed period the Peer Reviewers were allowed. Ultimately, EPA's unnecessary haste undermined the potential for high-quality assessment, and further calls into question the basic scientific rigor and objectivity of the Assessment.

2. EPA Manipulated the Peer Review Procedures To Minimize Criticism.

The Peer Review process was also managed in a way that seriously limited public input, and appears to have been designed to limit Peer Review criticism of the draft Assessment. Importantly, the Peer Reviewers were not given Pebble Limited Partnership ("PLP") or Northern Dynasty Minerals ("NDM") comments on the draft Assessment prior to the filing of their peer review submissions. The Open Meeting that EPA coordinated with the Peer Review panel was woefully inadequate for the level of public interest generated by the draft Assessment. Speakers were limited to *three minute* presentations *and* were forbidden from providing written submissions. EPA also directed the peer reviewers to respond to a set of questions ("the charge") that narrowed the scope of the peer review to topics selected by the Agency. PLP requested EPA to allow the peer reviewers to address other questions, but (with one minor exception) those requests were rejected. Such efforts to limit stakeholder input fly in the face of established Agency policy and guidance, not to mention EPA's own prior pronouncements with respect to this particular Assessment. EPA's Peer Review Handbook states that "[w]hen employing a public comment process as part of the peer review, Offices should provide the reviewers access to the public's comments that address scientific or technical issues." Peer Review Handbook § 3.3.1; *see also id.* at §§ 2.4.7, 1.5.3, 3.5.2 (echoing the obligation to provide access to significant public comments). Likewise, EPA's original Peer Review Plan for the Assessment indicated that EPA *would* indeed "provide significant and relevant public comments to the peer reviewers before they conduct their review." Peer Review Plan, http://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=241743 (select hyperlink to "Peer Review Plan"). For an Assessment evaluating the impacts of a potential future Pebble mine, surely the detailed technical comments of PLP and NDM were "significant and relevant." These comments plainly should have been provided to the Peer Reviewers.

---

[21] *See* U.S. EPA, Science Policy Council. *Peer Review Handbook* (3d ed.) ("Peer Review Handbook"), EPA/100/B-06/002 (2006).

Other EPA actions similarly exceeded the proper limits on its involvement in the Peer Review process. Two days after its Open Meeting with the peer review panel, EPA attended and participated in a closed meeting with the peer reviewers. The public was excluded from this meeting and the actual discussions have never been disclosed. Such *ex parte* contacts between EPA and the members of an appointed Peer Review team are prohibited. Where, as here, EPA has relied on a contractor to direct the peer review process, "EPA should limit direct contact to the prime contractor's designated representative and should not have general contact and direction to the contractor's staff or peer reviewers (sub-contractors)." Peer Review Handbook at § 3.5.3(b).

Finally, the summary of Peer Review comments on the first draft BBWA report prepared by EPA's contractor substantially understated the Peer Reviewers' criticisms. While the summary of the Peer Review panel's "Key Recommendations" generally reflects individual comments offered by the Peer Reviewers, missing from the "Key Recommendations" is the tone and incisiveness of the individual written comments. The "Key Recommendations" are in fact written as just that – recommendations, not *criticisms*. Many of the specific criticisms are not repeated, and often they do not appear except by implication. Those implications tend to be general and vague. In contrast, the individual critical comments tend to be specific, clear, and authoritative, in some cases denoting fundamental flaws in the Assessment. *See, e.g.*, Final Peer Review Report at 39 ("While some of the components of the final mine may contain elements of the conceptual mine, it is impossible to know whether the hypothetical mine scenario is realistic . . . . I therefore consider the mine scenario not sufficient for the assessment.").

3. EPA's Second Peer Review Ignored Transparency Entirely.

The peer review of the second draft of the Assessment was even more shielded from public scrutiny than was the first. Peer Review of the second draft of the Assessment (April 2013) was done in absolute secrecy and demonstrated even less regard for OMB Guidelines and EPA handbooks than the original Peer Review. The questions asked and responses received from the Peer Reviewers have never been disclosed, and EPA has communicated that it may publish the final Assessment before any public disclosure of the Peer Review comments has been made. EPA provided absolutely no public access to the Peer Reviewers over the course of the process, nor, insofar as we know, were the Peer Reviewers provided access to the comprehensive and highly detailed comments critical of the second draft of the Assessment prepared by PLP and NDM.

EPA's own peer review handbook shows EPA's astonishing degree of disregard of proper procedures. EPA wrote that "One important way to ensure decisions are based on defensible science is to have an open and transparent peer review process." Peer Review Handbook at xiii. The need for a transparent Peer Review process is not limited to any single aspect or phase of Peer Review. "In general, an agency conducting a peer review of a highly influential scientific assessment must ensure that the peer review process is transparent by making available to the public the written charge to the peer reviewers, the peer reviewers' names, the peer reviewers' report(s), and the agency's response to the peer reviewers'

reports(s)."[22] By denying stakeholders and the general public even the most basic information about the second Peer Review in advance of the final Assessment's release, EPA jeopardized the integrity of its peer review process.

Summary

A peer review should be a transparent process that allows experts to critique a draft report for scientific validity. EPA's manipulation of the peer review process here reveals other agendas. The most blatant was its attempt to use peer review to legitimize seven reports by self-professed mine opponents (and *none* by neutral parties or mine proponents, who submitted many scientific reports) by peer reviewing them. The peer reviewers found the studies to be biased and unreliable, but EPA used them anyway.

The peer review of the first draft of the Assessment was not an unrestricted, transparent critique: EPA imposed time constraints that limited the depth of the review; it restricted the charge questions; it limited public input to the peer reviewers to three-minute presentations; and it followed two days of public sessions with a next-day closed meeting that included EPA, excluded the public, and has never been transcribed. Despite these limitations, the peer reviewers recognized significant flaws in the report.

The peer review of the second draft of the Assessment was conducted *completely* in the dark. There was no public input at all, and no disclosure of peer reviewer comments. We do not know what the peer reviewers were asked to comment on, how much time they were given, or what they said. What was supposed to be transparent had become clandestine, thus diminishing the credibility and value of what should have been a salutary process.

The Inspector General Should Investigate Whether EPA's Actions Violate the Information Quality Act

A biased report and biased process violate the Information Quality Act ("IQA") and the OMB and EPA guidelines promulgated pursuant thereto. Section 515 of the IQA directs federal agencies to maximize "the quality, objectivity, utility, and integrity" of the information they create, collect, and disseminate. 44 U.S.C. § 3516 note. According to the OMB guidelines, "objectivity" requires disseminated information to be "presented in an accurate, clear, complete, and unbiased manner, and as a matter of substance, is accurate, reliable, and unbiased." Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies, 67 Fed. Reg. 8452, 8453 (Feb. 22, 2002). "Utility" is a requirement for the information to be useful. *Id.* at 8459. Stricter standards apply to information like the Assessment that is "influential."[23] Influential" information refers to

[22] Office of Management and Budget, *Final Information Quality Bulletin for Peer Review*, at 1-2 (Dec. 15, 2004).

[23] In addition to the obvious policy implications of the Assessment (EPA's stated intent to use the Assessment in later decision-making regarding a future Pebble mine), EPA's Peer Review Plan for the Assessment expressly designated it "highly influential." *See* http://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=241743.

(Continued...)

information that "will have or does have a clear and substantial impact (i.e., potential change or effect) on important public policies or private sector decisions." U.S. EPA, *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by the Environmental Protection Agency* ("2002 Guidelines"), EPA/260R-02-008, at 19 (Oct. 2002. As noted at the outset of this letter, a decision to veto this project would substantially harm the regional, Alaskan, and U.S. economies. OMB reminds agencies that it is "crucial that information Federal agencies disseminate meets these guidelines." *Id.* at 8452.

The EPA information-quality guidelines require EPA to ensure the objectivity of influential scientific information by relying on the "best available science and supporting studies conducted in accordance with sound and objective scientific practices." Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity, of Information Disseminated by the Environmental Protection Agency, EPA/260R-02-008, October 2002, at Sec. 6.4 (EPA applies quality standards adapted from the Safe Drinking Water Act to all agency risk assessments, including ecological risk assessments).[24]

Here, for the reasons described above, even the limited evidence available without an investigation strongly suggests that the EPA report fails to meet the IQA requirements for objectivity or utility.

Conclusion

The Pebble Project is among the most significant mineral deposits ever discovered. It has the potential to supply as much as one-quarter of the United States' copper needs over more than a century of production, while supporting 15,000 high-wage American jobs and contributing more than $2.5 billion to the country's GDP each year. It is located on State of Alaska lands accepted by the state as part of a land swap with the federal government specifically for its mineral potential, and designated through two public land-use planning processes for mineral exploration and development. It also appears to be the target of long-standing secret collaboration between senior EPA officials and environmental activists to secure the first-ever pre-emptive 404(c) veto of a major development project in the 43-year history of the Clean Water Act.

EPA Employees Have Been Working For Years to Promote a Veto

Furthermore, there is now considerable evidence from heavily redacted emails that the impetus for seeking a pre-emptive 404(c) veto of the Pebble Project did not come from federally recognized tribes in Alaska, as EPA has repeatedly claimed, but from agency officials themselves. This evidence, obtained under the Freedom of Information Act from EPA, suggests that EPA officials in Alaska began musing about the potential for a pre-emptive 404(c) veto of

[24] EPA guidelines available online at http://www.epa.gov/quality/informationguidelines/documents/EPA_InfoQualityGuidelines.pdf

the project, and lining up other federal agencies to support this plan, some two years before the first petition was received from federally recognized tribes. The heavily redacted emails produced by EPA have provided a glimpse into an unacknowledged EPA initiative, apparently begun by Phil North, to veto the Pebble project, to promote activist support for a veto, and to enlist other federal agencies such as the Fish and Wildlife Service to support a veto ("*This is going to happen and it's going to get bloody. I am looking forward to it!*"). This activity began secretly long before EPA received the petition that it claims caused EPA to initiate the Assessment. Its full scope is still unknown, and warrants further investigation.

EPA's routine collaboration with Pebble opponents, while keeping others in the dark (including PLP, mine project supporters, and the general public) shows an agency providing special access and special treatment to Pebble opponents. Emblematic of this collaboration is the transmittal of a letter from the Administrator to PLP's Chief Executive Officer, the only addressee of the letter, only *after* it was circulated to Pebble opponents.

The Assessment Report Is Biased to Support a Veto and Is Fundamentally Flawed

EPA's own agenda and its collaboration with mine opponents have produced an Assessment that violates EPA's own policies. The Assessment is a document written to create fears of calamity without ever assessing the real likelihood of harm to the salmon in Bristol Bay. Data in the report show that the entire mine scenario will occupy about $1/20^{th}$ of 1% of the total Bristol Bay watershed, and a similar proportion of its aquatic habitat. Even the vast 400 square mile watershed area surrounding Pebble produces only about one-half of 1% of the sockeye salmon upon which the Bristol Bay commercial fishery is based.

The Assessment evaluates a mine scenario co-authored by Mr. North (EPA's principal early advocate for a veto of the Pebble project) who has publicly admitted that he did not include state of the art technology because he assumed that mining companies would not use what is available. This critical flaw was recognized by numerous independent peer reviewers (selected by EPA), who said precisely the opposite—that the permitting process would require much more and better technology than what EPA used for its Assessment. This Assessment uses a mine scenario that fails to meet legal *requirements* to protect against harm to salmon, by assessing a fictional mine that does not meet modern standards for environmental protection.

By ignoring available evidence gathered by PLP and from public sources, the Assessment authors overstated the presence of salmon living where the mine is assumed to be constructed. It assumes that no mitigation will be available based on a report by avowed mine opponents who represent anti-Pebble activists. This assumption is belied by decades of evidence about the effectiveness of salmon habitat mitigation techniques.

For scientific support, the Assessment uses numerous studies by anti-mine activists. EPA quietly commissioned Peer Reviews of seven studies authored by anti-Pebble activists, presumably in hopes of bolstering their credibility. No studies supportive of the Pebble Project received any such treatment, including the Pebble Partnership's $150 million contribution of the

most comprehensive and relevant environmental data set available on the region. When EPA quietly had seven of those studies peer reviewed, EPA's own peer reviewers found them to be biased and unreliable, but EPA used them anyway.

EPA Manipulated the Peer Review Process to Support Its Preferred Result

Finally, EPA manipulated the peer review of the Assessment itself in a way designed to minimize criticism of the Assessment. EPA violated its own standards when, during the first peer review, it unduly restricted the schedule, shielded the peer reviewers from public comments, and then held a closed-door meeting with the peer review panel. During the second peer review, EPA shut out the public entirely, completely violating its own standards for transparency.

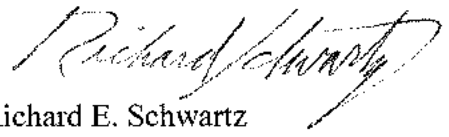
For the first peer review, EPA provided a very narrow charge to the Peer Reviewers for their review of the initial watershed assessment draft in 2012, and limited public access to the Peer Review panel to three-minute per-person verbal presentations. EPA met with Peer Reviewers in private, refused to release their full reports on the watershed assessment document and subsequently published a significantly watered down summary report. Notwithstanding these limitations, the Peer Reviewers gave voice to some very serious criticisms of the watershed assessment, some of which are presented in this submission.

For the second draft of the watershed assessment in 2013, EPA provided its charge to Peer Reviewers in private. In fact, no public access to the Peer Reviewers was permitted whatsoever, and EPA recently reported it may publish the final draft of the watershed assessment before any Peer Review input is made public. While EPA's management of the Peer Review process in 2012 fell well short of the agency's own guidelines for such processes, the 2013 Peer Review made an open mockery of them.

Request for Investigation

In summary, the agency's bias has created a heavily biased scientific report that contravenes the IQA prohibition against allowing bias to infect the agency's scientific assessment of environmental risk. We respectfully request that the Inspector General investigate the issues raised above. We would greatly appreciate your timely attention to these EPA activities, and we would be pleased to meet with you to discuss any aspect of this request.

Sincerely,



Richard E. Schwartz
Attorney for Northern Dynasty Minerals Ltd.

EXHIBIT G

1001 Pennsylvania Avenue, NW, Washington, DC 20004-2595 ▪ p 202 624-2500 ▪ f 202 628-5116

crowell moring

Richard E. Schwartz, Esq.
rschwartz@crowell.com
(202) 624-2905

March 19, 2014

By Electronic Mail and Hand Delivery

Arthur A. Elkins, Jr. (2410T)
Inspector General
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Re: #2014-44 – Bias Trumps Science: Second Update to Request For Investigation Concerning EPA Bristol Bay Watershed Assessment

Dear Mr. Elkins:

I am writing on behalf of Northern Dynasty Minerals Ltd., owner of the Pebble Limited Partnership ("PLP"), to apprise you of what we have discovered from the completion of our review of the heavily-redacted emails that EPA produced in response to PLP's Freedom of Information Act requests. EPA's production leaves many gaps in this story, but the emails that escaped withholding and the words that escaped redaction reveal an Agency ecologist who believed in 2008 that mining the Pebble deposit would bring development that would harm salmon in the Bristol Bay watershed. He also knew that a mine would need a Clean Water Act Section 404 permit and believed that EPA could veto it, so he set out to garner support for a veto.

This EPA ecologist, Phillip North, initially recruited his EPA colleagues to support his position, then expanded his efforts to include the U.S. Fish and Wildlife Service. As more EPA personnel—both at Region 10 and at Headquarters—supported his efforts to oppose a Pebble mine, they brought mine opponents into EPA's inner circle and exchanged anti-mine strategy with them. Eventually both EPA Region 10 and EPA headquarters secretly gave those groups unbridled access to EPA's thinking and strategy. In the meantime, groups that might favor the mine—including the State of Alaska—were kept ignorant of the ongoing strategy discussions with mine opponents. EPA's one-sided embrace of anti-mine information resulted in a grossly biased watershed assessment[1] structured to support the mine veto that Mr. North had been advocating since roughly 2008. Imbalance in access nurtured imbalanced policy—which

[1] The final document, entitled "An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska" (EPA 910-R-14-001A; January 2014) ("the Final Assessment"), was issued on January 15, 2014.

produced an imbalanced assessment report. We hope that an investigation will cast sunlight on this secret process, which produced a biased document unworthy of the Agency that produced it.

1. Introduction

EPA claims that it initiated the Bristol Bay watershed assessment process in response to petitions by tribes asking EPA to veto mining of the Pebble Deposit in Southwest Alaska. Documents obtained under the Freedom of Information Act offer a far different picture of the origin of this process. This letter further describes how the 404(c) process actually began – long before the tribes formally requested it – and how EPA's intimate dealings with ENGOs and 404(c) advocates were an integral and secret part of the process.

Unfortunately, major gaps in the documents produced under the FOIA request make it impossible to get a complete picture of the EPA's activities. For example, the EPA employee directly responsible for launching the EPA 404(c) veto effort was an EPA ecologist working in Alaska, Phillip North. The section of this letter immediately below covers the 22-month period from July 2008 to May 2010, when Mr. North was aggressively pushing his colleagues to pursue a 404(c) veto of a Pebble mine. During this same period there are two seven month gaps, each with no emails at all from Mr. North who, by all other indications, was actively pursuing a Pebble veto. Similarly, we know that the private lawyer most aggressively pursuing a Pebble veto was Mr. Geoffrey Parker, and we know that he used Mr. North's home email at least once to send him a memo about Pebble strategy. We know this only because Mr. Parker evidently made a mistake and forwarded the same email to another EPA employee, thus (probably inadvertently) putting evidence of his use of Mr. North's home email into EPA's own email records.

Despite these gaps, the information that can be gleaned from the documents that EPA produced underscores the need for the Inspector General to investigate and for EPA to produce documents that it withheld from disclosure.

2. Phillip North Launches "my 404 review" in 2008

EPA ecologist Phillip North, one of the authors of the Bristol Bay Watershed Assessment, was working on what he called "my 404 review" nearly two years before the tribes petitioned EPA to initiate the 404(c) process. The initial tribes' request for a 404(c) process was sent to EPA on May 21, 2010 and received on May 25, 2010. EPA announced plans for the Bristol Bay Watershed Assessment, citing the tribes' request, on February 7, 2011.

Mr. North was an ecologist in the Aquatic Resources Unit (ARU) in the Office of Ecosystems, Tribal and Public Affairs at EPA Region 10. His exploration of an EPA veto of a Pebble mine permit was already ongoing by June 16, 2008, when he wrote to EPA Region 10 toxicologist Jean Zodrow in Seattle asking her to review a report on copper toxicity to salmon. "It has bearing on my 404 review," North wrote. **[Ex. 1]** The report was cited in a 50-page law

review article by Geoffrey Parker and others[2] which North received the same day from EPA mining coordinator Patricia McGrath. North's email to Ms. Zodrow was also copied to John Pavitt in the EPA Office of Compliance and Enforcement in Anchorage. The FOIA production does not include a response to North.

On August 20, 2008, Mr. North wrote Ms. McGrath asking if she was planning a mining retreat so he could discuss Pebble 404 issues in a "mini-retreat" devoted to Pebble. On August 26, McGrath replied that she was not planning a retreat but asked what he wanted to discuss. North replied that he would like to discuss Pebble issues "in collaboration with the other Regional experts involved . . . . to identify areas where we are confident in our position, or at least direction, and areas where we are not . . . ." **[Ex. 2]** He concluded that "[t]he 404 program has a major role. I would like to get the benefit of hearing what other EPA folks are thinking." **[Ex. --]** Thus North was actively investigating the possibility of a Section 404(c) veto 21 months before the tribes filed the first 404(c) petition and 2 ½ years before EPA announced it was embarking on the Bristol Bay Watershed Assessment.

In November 2008 a few people at EPA recognized that because they would need to make regulatory decisions about the Pebble mine, EPA should remain neutral and unbiased about this subject. Mike Gearheard of EPA Region 10 wrote that putting the film about Bristol Bay entitled "Red Gold" on the agenda of Region 10's Executive Team meeting in December 2008 "could give the appearance that Region 10 is not remaining objective and unbiased in our important permitting role. Also, the pro-mining interests might seek to have equal time on our agenda." (Ex.—[11/4/08]) Ms. McGrath replied "I don't see a need for the [Executive Team] to view this film. The main reason being that we do not yet have a regulatory role in Pebble. The Pebble Partnership has not developed a firm project description. No permit applications have been submitted . . . . I agree with your concern that we not appear to be favoring either side . . . . The Pebble team and our mining team has strived to remain neutral amid all the controversy." In all of the EPA email we have reviewed, the foregoing exchange is the *only* expression of concern that EPA should remain objective and unbiased. The rest of the history shows an Agency astonishingly comfortable taking the anti-mine side, catering to anti-mine activists, and steeping itself in anti-mine advocacy.

On December 31, 2008, Mr. North again proposed a retreat in an email to Pavitt: "Any thought on the retreat we discussed when I was there?" **[Ex. 3]** There is no response in the record.

On January 8, 2009, Mr. North revealed that he was certain that a Pebble mine would lead to catastrophe. Repeating his concerns about tailings, North wrote, "Over time it seems that the likelihood of a catastrophic failure becomes a certainty" and he envisioned harm that would extend "to the food chain of the North Pacific." In this email to Alaska Department of Fish and Game biologist Ted Otis and copied to Phil Brna, a biologist for the U.S. Fish and Wildlife

[2] Pebble Mine: Fish, Minerals and Testing the Limits of Alaska's "Large Mine Permitting Process." Geoffrey Y. Parker, Frances M. Raskin, Carol Ann Woody, Lance Trasky. Alaska Law Review Vol. 25:1. 2008.

Service, and to EPA's Pavitt, North concluded: "We probably ought to start big (North Pacific) then work back to a consensus on what the extent of effects are likely to be." **[Ex. 4]**

Considering Mr. North's activism inside the agency, there is a surprising absence of communications by North from January through July 2009. On August 17, 2009, North again proposed a retreat to discuss subjecting Pebble to a 404(c) veto. He wrote to EPA Alaska chief Marcia Combes and to Michael Szerlog, the Region 10 manager for North's Aquatic Resources Unit, proposing the 404(c) discussion as part of a Region 10 retreat in Seattle. North proposed adding an entire day at the beginning, on September 16, to discuss the Chuitna and Pebble Mines in relation to NEPA, NPDES and 404 issues. North proposed that he would lead the 404 discussion, including "the EPA position" and "appropriate action in response to our position."

As you know, I feel that both of these projects merit consideration of a 404C veto. We will discuss this from a technical perspective and staff perspective at these meetings. **[Ex. 5]** (emphasis added) Apparently this was not the beginning of the discussion, as evidenced by North's opening ("As you know..."). The opening phrase makes EPA's failure to produce any documents written in the months preceding this email worthy of further investigation.

Mr. North's bosses accepted his proposal for a special one-day meeting on September 16, 2009 in which he would lead the discussion on 404(c) issues. On August 24, 2009, North sent the agenda to the mining team. **[Ex. 6]**

The retreat featured a PowerPoint presentation by Mr. North – a presentation that was not produced by EPA under the FOIA request. North himself referred to the PowerPoint presentation in a September 28, 2009 email to Mr. Pavitt and Ms. McGrath in which he passed along information from the NGO Skytruth, which was the source of the Pebble footprint North used in his presentation. **[Ex. 7]**

On October 13, 2009, Mr. North set up a management briefing and discussion about Pebble for November 12, 2009. **[Ex. 8]** The announcement includes a complete redaction of the section called "Personal Notes."

Then Mr. North's communications disappear from the email traffic for months, although the fruits of his labor appear in top EPA briefings in January and February 2010 highlighting the future 404(c) option.

On May 12, 2010, before Mr. Parker submitted the tribe's petition, Mr. North emailed Parker saying: "Hi Jeff.[3] The PLP [Pebble Limited Partnership] web site lists the following Bristol Bay tribes as having passed resolutions favoring the mine. Do you know otherwise?" **[Ex. 9]** That North would ask Parker for information about tribes apparently favoring the mine indicates both that North was taking the initiative to identify public allies and opponents, and that

[3] Parker signed the 404(c) request on behalf of the tribes Geoffrey Parker, but in his emails he consistently uses Jeff Parker.

he and Parker enjoyed a close working relationship that extended to this subject, which should have been outside Mr. North's job description.

In the days immediately before and after tribes submitted their petition prepared by Mr. Parker, EPA produced no communications by North.

On May 24, 2010, Mr. Parker emailed the 404(c) petition to EPA attorney Cara Steiner-Riley. On May 25, she forwarded it to North and several others. **[Ex. 10]** Top EPA officials sent word of the petition to management that same day. **[Ex. 11]**

3. North's Efforts Refine EPA's 404(c) Strategy

In the months immediately following the six-tribe petition, Mr. North was actively encouraging tribal involvement and stepping up his crusade for 404(c) action.

Mr. North's next known communication with Mr. Parker is a June 9, 2010 email in which North thanked Parker for sending him items which North described as a "strong argument for a broad approach to 404(c) and to separate it from the Pebble project. **[Ex. 12]**

On June 25, 2010, Mr. North wrote Richard King, administrator of the Curyung Tribal Council (one of the original six tribes), with a copy to Parker, encouraging this outside group to actively pressure his agency to oppose the mine. North wrote: "Tribes have a special role in Pebble issues because of government-to-government relations. EPA takes that very seriously. I encourage you to develop that relationship as much as you can. I look forward to talking with you more in the future." **[Ex. 13]**

On August 12, 2010, the Bristol Bay Native Corporation filed its own 404(c) request, and BBNC lawyer Peter Van Tuyn sent it directly to North with a message indicating that he expected to collaborate with North: "I look forward to catching up with you in the coming days."

Mr. North's reply was not that of a dispassionate scientist seeking objective information, but someone seeking an outside ally for a 404(c) veto action: "Hi Peter, We have been discussing 404(c) quite a bit internally at all levels of EPA. This letter will certainly stoke the fire. I look forward to talking with you in the near future." **[Ex. 14]**

When Mr. North wrote this reply in August 2010, he had been generating discussions about a Pebble 404(c) veto for more than two years.

On September 14, 2010, Mr. North wrote one of the most revealing descriptions of his approach. In an email to Richard Parkin, the EPA Pebble team leader, and ARU manager Michael Szerlog:

> I hope everyone at this point has gotten their minds around the idea that our focus is on the resource and not on any particular project. To that end, here are some thoughts about how I might approach a 404(c) action. The landscape area that supports the resource we

> are discussing is the Bristol Bay watershed. So initially it seems that area should be the target of our 404(c) action. During the process of developing our proposed determination we would refine our target area based on the need for protection." **[Ex. 15]**

Then before going into details, Mr. North prefaces his argument: "Not to be predecisional . . . ." North, of course, has been "predecisional" for more than two years, when he began pushing the 404(c) issue and openly declared that EPA should use its veto power. But by September 2010 he was talking in terms of "our 404(c) action" as a given.

What makes this email particularly noteworthy are the issues Mr. North brings up next. His ultimate goal is to prevent *all* development in the Bristol Bay watershed. Stopping the mine is the frontline of his broader battle against mining, roads, and residential and commercial development in the watershed.

> So far there are two types of development that have been identified in State of Alaska planning documents that could have significant adverse effects on aquatic resources. The first is what drew our attention here, mining. The second is road building. The State of Alaska has outlined an extensive road system that does not currently exist. If it was constructed as proposed, it would cause significant adverse effects.
>
> . . . . it is the accumulation of mines and highways, and all the associated residential and commercial development enabled by the larger scale developments, that will ultimately cause the demise of the resources we are targeting.
>
> So a 404c that targets the primary habitat of the resource we are trying to protect, salmon, is a logical approach. First at the specific habitat level by prohibiting discharge in stream channels and the riparian (or adjacent) wetlands that most directly support them. Second by initially addressing Bristol Bay as a whole then narrowing to those watersheds that are at risk.

This email carries the subject line: "Thoughts for the Bristol Bay discussion tomorrow." EPA's FOIA production offers no agenda, no follow-up email and no other communication about this discussion of "our 404(c) action."

On the same day that Mr. North sent this veto-strategy email to his EPA management, he forwarded it to Mr. Parker, an anti-mine advocate outside the agency.

4. Parker and North Shared Information Privately

The working relationship between Mr. North and Mr. Parker was a two-way street and involved more than North forwarding internal EPA communications to Parker.

On September 22, 2011, Mr. Parker sent an email to Palmer Hough of the EPA Wetlands Division in Washington, D.C. with two documents attached: Parker's own draft "History of Conservation and Land Use Planning Efforts in the Kvichak and Nushagak Drainages" and a

memo entitled, "Assuming that EPA makes a 404(c) determination regarding the Kvichak and Nushagak drainages, what can make it stable under future federal administrations?"

Mr. Parker's email to Hough was a forwarded message that he had sent on September 21, 2011 to "Phil and Amanda." **[Ex. 16]** Amanda is Phil North's wife. This email originally went to North's home email account and nowhere else.

Many emails sent by Mr. Parker have redactions. This email suggests that Parker used North's home email address when he wanted to communicate privately with North, off the federal communications grid. These emails, between Parker and North's home, would not turn up during a FOIA production, and we assume that this was the reason for using a private email – to keep the material private.

The only reason we have this North-Parker exchange via North's private email is that it was forwarded to Palmer Hough. In fact, all email correspondence relevant to Mr. North's activities concerning Pebble to or from Mr. North's private email account should have been produced. The Inspector General should investigate the withholding of such documents. The few North-Parker emails that were produced show what appears to be a close working relationship between North and Parker—the lawyer who filed the initial 404(c) petition for the six tribes.

On July 17, 2013, The Redoubt Reporter published a feature article on Mr. North highlighting his significant personal role in the 404(c) process.[4] North had just retired from EPA and was preparing to embark on an around-the-world sailing trip. Scrolling down beyond the end of the online article about North, there is a comment by Parker: "We all owe him a lot. Best sailing. Jeff." **[Ex. 17]**

5. EPA Briefings Highlight 404(c) Before the Tribes Petition EPA

On January 13, 2010 – 5 ½ months before EPA received the tribes' 404(c) request – EPA Region 10 briefed Administrator Lisa Jackson about Pebble, highlighting the 404(c) veto option. **[Ex. 18]**

On January 26, 2010, Susan Bromm, Director of the EPA Office of Federal Activities, which coordinates review of all federal environmental impact statements and compliance with NEPA, requested a briefing. **[Ex. 19]** Like Jackson, her February 2, 2010 briefing highlighted the 404(c) veto option. **[Ex. 20]**

On June 8, 2010, less than two weeks after EPA received tribes' 404(c) request, Mr. North was in Seattle to brief Regional Administrator Dennis McLerran with the "Key Message"

[4] http://redoubtreporter.wordpress.com/2013/07/17/full-phil-epas-north-sets-sail-after-eventful-career-helping-launch-bristol-bay-pebble-mine-assessment/

that "EPA will be heavily involved in this project" through NEPA review, 404 oversight and NPDES oversight. And, as in the earlier briefings prior to the tribes' petition, North highlighted this future option: "404(c) veto either pre-emptive, during EIS, or after EIS." **[Ex. 21]**

6. EPA Sought Veto Support From the U.S. Fish & Wildlife Service

Mr. North's role as a 404(c) advocate within EPA spilled over into other federal agencies, including the FWS. As a result, FWS was suddenly deeply enmeshed in EPA's 404(c) strategy and activities. North recruited FWS officials to his 404(c) crusade months before EPA announced it would conduct a Bristol Bay watershed assessment.

The Anchorage Fish and Wildlife Field Office (AFWFO) produced a discussion paper dated October 1, 2010 stating that EPA had decided to launch the 404(c) process; that it had enlisted the support of the FWS Region 7 (Alaska); and that it was only a matter of when (not whether) EPA would act. The 3-page FWS paper – dated more than four months *before* EPA's public announcement – was titled "EPA to Seek Service Support *When* They Use Section 404(c) of the Clean Water Act." **[Ex. 22]** (emphasis added)

On October 18, 2010, Brna consulted with Mr. North, who requested up to two hours for EPA to brief the FWS regional director. FWS Deputy Assistant Regional Director Steve Klosiewski told Brna and other FWS officials, "We need a short concise briefing that allows time for meaningful discussion. *No need to talk about how bad the mine would be because everyone understands this.* We need to focus on FWS role and authorities and what EPA wants from us. We should know this before the meeting and discuss beforehand." (emphasis added) On October 20, 2010, FWS Regional Coordinator for Conservation Planning Assistance Frances Mann said the 2-hour briefing was necessary to discuss details of what she repeatedly referred to as the "404(c) action":

> The briefing will be given by EPA, not the Service. We have already given our briefing to Geoff, he said he was convinced, and directed us to set up the formal briefing with the RDs of the EPA and the NPS (a side note is that he also asked us to set up a second briefing with the Alaska Native delegation that are petitioning EPA to undertake the 404(c)).
>
> The EPA briefing does not focus on the mine and how bad it is. Rather – it focuses on the uniqueness and global importance of the Bristol Bay watershed, particularly the importance of salmon to the economy, the people, etc. It also provides info about other non-salmon resources in the area. *The briefing describes the EPA criteria for taking the 404(c) action.* Pebble and other mines are mentioned as significant threats to the area, but the presentation does not go into detail about the adverse effects of mining.
>
> The briefing would be essentially the same one that has been given to EPA's Regional Administrator in Seattle, as well as the Deputy Administrator (in Wash DC). According to Phil North, those briefings/discussions took about 1.5 hours. The rationale behind the

> 2-hour time block is that we don't know what sorts of questions and discussion may need to occur between the 3 RDs (Sue Masica, Marcia Combes and Geoff), but it seems better to be safe and allow for more time rather than less. *The EPA will be looking for a statement of support from Geoff and Sue as to the merits of the 404(c) action. This is their time to tell a convincing story about why 404(c) action would be appropriate.* I think this is actually the type of information that Geoff and the NPS will need when asked by Rowan, Tom Strickland, the public and others about "why are you in support of the EPA's action?"[5] **[Ex. 23]** (emphasis added)

These FWS statements -- the October 1 discussion paper and the October 20 email by Ms. Mann – confirm that EPA had decided to pursue a 404(c) veto *before* it began its watershed assessment.

Mr. North conducted the briefing described above in December 2010 for the FWS and NPS regional directors. On February 25, 2011, while preparing for FWS meetings, Anchorage Field Office Supervisor Ann Rappoport wrote Phil Brna asking for North's presentation: "I believe there were some good facts in Phil North's presentation last Dec. to FWS and NPS Regional Director's [sic]. Phil – I believe you have that – can you pull out those slides with info on species (it also included terrestrial ones), numbers, value of commercial and recreational fisheries, portion of world wild salmon fisheries, etc. and forward them to Larry [Bright, FWS Chief of Conservation Planning Assistance]?" **[Ex. 24]** Brna was one of two FWS officials who contributed to the EPA watershed assessment report. North's presentation was not produced by EPA or FWS under the FOIA documents request.

On February 24, 2011, FWS agreed to a request from Trout Unlimited for a meeting at FWS headquarters to discuss "the use of CWA Section 404c to protect the watershed from the mine proposal." **[Ex. 25]** When FWS headquarters notified FWS Regional Coordinator for Conservation Planning Assistance, Frances Mann, that it had agreed to the Trout Unlimited meeting, her response was: "wow! Great news! What do you need from us?"

To prepare FWS officials, Ann Rappoport sent out the earlier October 1, 2010 discussion paper: "EPA to Seek Service Support When They Use Section 404(c) of the Clean Water Act."

FWS emails in March 2011 show the service engaged with key 404(c) advocates and strategizing about how to bring their cause all the way up to the secretary level.

---

[5] The names in this email refer to the following officials in the order they are mentioned: Geoff Haskett, Alaska Regional Director the USFWS; Sue Masica, Alaska Regional Director for the National Park Service; Marcia Combes, Alaska EPA Operations Director; Rowan Gould, Deputy Director of the USFWS; Tom Strickland, Assistant Secretary of the Interior for Fish and Wildlife and Parks.

7. 404(c) Advocates – EPA Partners and Insiders

The FOIA production shows almost constant contact between EPA and environmental nongovernment organizations, with private meeting, calls, briefings and document exchanges so frequent that they became part of the EPA routine. The tone of the communications portrays EPA and the ENGOs as partners with a common goal. What likely began as a lobbying effort soon became an intimate working relationship.

The ENGOs began working with EPA in 2009. By the time the 404(c) petitions were filed in 2010, the ENGO-EPA relations had escalated to the point where there were almost constant briefings and two-way exchanges. ENGOs and EPA were sharing information, patting each other on the back with appreciation, and moving in lock-step.

Even the foundations funding the ENGOs got into the act, scheduling meetings with EPA officials at headquarters to lobby for their grantees' cause.

What began as ENGO requests for meetings evolved into EPA invitations to the ENGOs for meetings and briefings. These activities were private and they exclusively involved 404(c) advocates. When EPA conducted its own internal briefings and communications, it freely shared these materials with the ENGOs.

Phil North frequently invited Trout Unlimited Bristol Bay Campaign Director Shoren Brown to meet with him and even to join him for field research training. Geoffrey Parker sent advice to EPA on policy, law and tactics. Lobbyist and former EPA official Wayne Nastri did the same, offering regular advice to his former colleagues, which they graciously accepted. In 2010 The Wilderness Society was copied on almost every EPA email that went to tribes and key players. The Natural Resources Defense Council scheduled meetings with its former attorney Nancy Stoner who left NRDC to become EPA assistant administrator for water. Some of the most vocal 404(c) activists, such as Shoren Brown, Robert Waldrop, Rick Halford, John Holman and others, insinuated themselves into the process in numerous ways. ENGOs made sure EPA got the reports they produced or paid for, including drafts, embargoed reports and materials not otherwise released or reviewed independently. EPA itself was instrumental in encouraging ENGO contacts with other agencies, particularly the U.S. Fish and Wildlife Service.

Although many of these ENGOs, their principals, their lawyers and their lobbyists worked together, this section will attempt to describe the activities of key advocates separately because of the sheer volume of material. This is not a complete accounting of EPA-ENGO meetings, and gaps in the FOIA record prevent a complete listing. The following summary focuses on the key early meetings between EPA and the most active ENGOs. It spotlights meetings in the critical formative months and emphasizes on the period leading up to the public EPA 404(c) announcement in February 2011.

8. ENGOs & EPA: 2008 – 2009

The earliest events in the FOIA record involving EPA and the 404(c) advocates occurred in 2008. The 2008 law review article by Parker and others figured in the first email referring to the 404(c) project which North sent to the EPA toxicologist in July 2008 as described above.

The "Save Bristol Bay" web site, operated by Trout Unlimited, and other anti-Pebble groups began promoting a film called "Red Gold" in 2008. The producer approached EPA about a showing in October 2008, and EPA showed interest. Some at EPA expressed concerns about the appearance of bias if EPA were to schedule a meeting that including a movie critical of Pebble and produced by Pebble opponents.

On November 7, 2008, EPA Alaska Mining Coordinator Patricia McGrath wrote her colleagues concerned over an advocacy group, Save Bristol Bay, sponsoring the film. She also said she saw no need for the executive team to view the film because "we do not yet have a regulatory role in Pebble. The Pebble Partnership has not developed a firm project description. No permit applications have been submitted and it is unlikely we will begin NEPA and permitting before late 2011." **[Ex. 26]**

Ms. McGrath went on to say that she agreed with concerns "that we not appear to be favoring either side in the controversy surrounding this mine." She suggested, "One option might be to view this film as a brown bag event. Another option would be to present, at the ET meeting, materials that describe other points of view."

Mr. North, of course, by this time was already working on his 404(c) plans and it wouldn't be long before EPA dropped all pretense of impartiality and began courting ENGOs. Meanwhile, EPA resolved that debate about watching the movie on EPA time by scheduling a February 12, 2009 "Brown Bag showing of Red Gold film." **[Ex. 27]**

On June 30, 2009, Mr. Parker met with EPA and sought to become involved with EPA and the Army Corps of Engineers in a future environmental impact statement for Pebble. Parker was already representing the six tribes in a challenge to the state's 2005 Bristol Bay Area Plan. On September 16, 2009, Parker asked EPA who he should contact to "commence initial discussions" on having the tribes work as "cooperating agencies" with EPA. He was referred to EPA Pebble Project Manager John Pavitt. **[Ex. 28]**

On October 30, 2009, David Chambers of the Center for Science in Public Participation (csp2) contacted EPA to set up a Pebble discussion. EPA agreed, and on November 11, 2009, Chambers wrote that he was also working with other groups: "I work with a number of NGOs to look at the technical aspects (geochemistry, hydrology, mining and processing, fisheries) of the Pebble mine." **[Ex. 29]**

Mr. Chambers told EPA he was bringing his colleague Kendra Zamzow along with four others – all of them active Pebble opponents and 404(c) advocates: Carol Ann Woody, Jeffrey Parker, Luki Akelkok and Bobby Andrew.

Ms. Woody is a fisheries biologist whose company Fisheries Research and Consulting works for Pebble opponents. Parker and Woody were co-authors of the 2008 law review article against Pebble, the article North sent to EPA toxicologist Jean Zodrow in July 2008 for what he called "my 404 review."

Mr. Akelkok and Mr. Andrew both served as directors of the ENGOs Nunamta Aukulestai and Bristol Bay Heritage Land Trust. Mr. Akelkok is president of Ekwok Village Council, one of the six tribes represented by Parker in the 404(c) petition. Akelkok chaired the 2008 Clean Water Initiative, a campaign funded largely by Robert Gillam and intended to prevent Pebble development. Mr. Andrew is treasurer the Renewable Resources Foundation, which was founded by Gillam and along with Gillam is the sole source of money for the latest anti-Pebble ballot initiative, Bristol Bay Forever.

On October 5, 2009, EPA mining coordinator Patricia McGrath emailed North and others to report that "TU [Trout Unlimited] folks are meeting with HQ water office in a couple weeks. Not sure if we will be asked to participate or provide information." **[Ex. 30]** Then, as a follow-up, on November 4, 2009, TU Bristol Bay Campaign Director Shoren Brown wrote that he had met with EPA in Washington, D.C. and wanted to meet with Region 10 officials. **[Ex. 31]**

The FOIA record has nothing more on any of these 2009 meetings.

9. Attorney Geoffrey Parker

FOIA documents show that Geoffrey Parker was far more engaged in the entire EPA 404(c) process than filing a petition for six tribes. Mr. Parker became a de facto EPA advisor, regularly sending writings and suggestions to EPA to further the 404(c) process.

On May 7, 2010, Mr. Parker wrote an 8-page letter to Regional Administrator Dennis McLerran focusing on his definition of a 404(c) "unacceptable adverse effect" of Pebble mine development on such things as the sport fishing economy and subsistence. Parker said the letter was accompanied by a request from "several" tribes to initiate a formal 404(c) assessment. **[Ex. 32]** Parker's May 7, 2010 letter was copied to two people: U.S. EPA Administrator Lisa Jackson and Region 10 ecologist Phil North.

Two parties that were *not* informed of the petition by either the petitioners or by EPA were the direct targets—the State of Alaska , which owned the land, and PLP, which leased the mineral rights. This was no accident. EPA and the ENGOs worked together to keep the petition secret from the State and PLP until a story in the *Los Angeles Times* broke the secret.

On June 11, 2010, Mr. Parker sent EPA "contact information for my tribal and other clients for purposes of arranging any meeting responsive to Mr. Akelkok's invitation of April 14, 2010 to Mr. McLerran, regarding the potential Pebble mine, the Tribes' 404(c) request, and

related matters." Parker said he had spoken with North and was expecting a response to the April meeting request. **[Ex. 33]**

In addition to the six tribes, Mr. Parker's 404(c) client contact list included the Trout Unlimited Alaska Director Tim Bristol and David Harsila, President of the Alaska Independent Fishermen's Marketing Association (AIFMA).

On June 22, 2010, Mr. Parker asked EPA attorney Cara Steiner-Riley to tell him how her ENGO meeting went with Trout Unlimited and David Chambers of csp2. She agreed to brief him. **[Ex. 34]**

On June 28, 2010, Mr. Parker wrote Ms. Steiner-Riley, copied Mr. North, and suggested a 404(c) strategy: "One option that EPA might consider is to commence a 404(c) process based on the 2006 applications." He was apparently referring to Pebble exploration applications on file with the Alaska Department of Natural Resources. **[Ex. 35]**

On July 14, 2010, when Mr. Parker learned that Administrator Jackson and Mr. McLerran were leading an EPA visit to the region, he jumped in to advise EPA about the meetings on behalf of the petitioning tribes. **[Ex. 36]** In a July 15, 2010 email, Parker suggested how EPA should handle the meetings:

> I understand that if EPA acts under 404(c), then EPA may do so to form a "positive" point of view – i.e., to protect the Kvichak and Nushagak drainages (or the Bristol Bay drainages) from unacceptable adverse effects such as those posed by Pebble mine – rather than from a negative point of view – i.e., to stop Pebble Mine per se. **[Ex. 37]**

Ms. Fordham's same-day reply stated that EPA would not be discussing the 404(c) issue. Parker wrote back on July 16, 2010, to get assurances that all six petitioning tribes will be invited, and informed Fordham that it was the 404(c) request itself that precipitated the Jackson-McLerran-EPA visit:

> I understand that this meeting is precipitated, at least in substantial part, by the 404(c) letter that these six tribal governments sent to Mr. McLerran and Ms. Jackson, the letter of Mr. Akelkok that invites Mr. McLerran and follow-up efforts of Mr. King, and efforts of EPA officials involved in responding to the Tribes' 404(c) letter. **[Ex. 38]**

Also on July 16, 2010, Mr. Parker wrote Ms. Fordham again, complaining that his clients were left out of the EPA visit plans. "I trust this is now being straightened out. Please keep me informed. I recommended that all six tribes that requested 404(c) be invited." Parker also urged EPA to include other mine opponents: "I also recommend that you include AIFMA and TU, both of which have supported the tribes on 404(c), and have recommended that EPA coordinate with those six tribes." This time, Parker included North and several other EPA officials in the email.

Mr. Parker's requested guest list may have been adopted by EPA. A new email from Fordham with an update on the visit has a long list of addressees, *but the entire addressee block is redacted* so it cannot be determined whom EPA invited to this meeting. **[Ex. 39]**

On July 17, Mr. Parker distributed a map of mining claims he received from mine opponent Carol Ann Woody. It apparently went to EPA's distribution list for the Jackson visit as well as to Ms. Steiner-Riley. **[Ex. 40]** On July 18, 2010, Parker reports that Woody's map was actually prepared by another ENGO, The Nature Conservancy. **[Ex. 41]**

On July 30, 2010, Mr. Parker wrote Ms. McGrath and Michelle DePass, EPA Assistant Administrator for International and Tribal Affairs who was accompanying Jackson on her visit to Bristol Bay, including the town of Dillingham, where events were scheduled. Parker warned EPA: "I learned this morning that a reporter, Kim Murphy, at the LA Times, is doing a Pebble-related update. She had already learned of the Dillingham meeting and the 404(c) matter." **[Ex. 42]**

What makes this email so significant is that the tribes' 404(c) petition had not yet been publicly disclosed. Mr. Parker's email suggests that perhaps Jackson herself intended to disclose it at the Dillingham meeting. In fact, even PLP was unaware of the 404(c) petition more than five weeks after Parker submitted it.

Mr. Parker's warning email to EPA about the LA Times and the imminent disclosure of the 404(c) petition included a list of talking points that EPA could use, as could his clients. Parker's No. 1 point: "Tribes have used their government-to-government relationship with the United States to ask EPA to consider commencing a 404(c) public process." (emphasis in the original) Parker said the 404(c) process was "a means to protect fish and game habitat and commercial, subsistence and sports uses of fish and game" and that it was a "highly deliberative process." EPA officials forwarded the email to its upper management.

On August 3, 2010, the LA Times published an article entitled, "Battle over Pebble Mine shifts to EPA."[6] The article quoted Parker and his various talking points, and the article included a link to the tribes' letter to EPA. *That is how PLP discovered the existence of the 404(c) petition filed by the tribes in May – not from EPA.* Even when the EPA officials were in Alaska, they did not disclose the 404(c) request in meetings with Pebble officials. It was only because the news leaked, because Parker talked about it and because the petition was given to the LA Times that PLP itself learned of its existence.

Mr. Parker's next order of business, according to an August 11, 2010 email, involved setting up a meeting with EPA and the Army Corps of Engineers for August 13. Parker spelled out in detail what he wanted to cover and what he wanted to get as a result. Throughout, there are references to the information that the parties will provide to Parker and the tribes. **[Ex. 43]** On August 12, 2010, Parker sent out a refined agenda for EPA-Corps meeting. **[Ex. 44]**

[6] http://latimesblogs.latimes.com/greenspace/2010/08/battle-over-pebble-mine-shifts-to-epa.html

The Bristol Bay Native Corporation filed its own 404(c) request on August 12, 2010, and BBNC lawyer Peter Van Tuyn sent a copy to Parker and Meacham, lawyers the six tribes. Parker then sent the BBNC 404(c) petition to someone at EPA with no message except "fyi"; yet the addressee is inexplicably redacted. **[Ex. 45]**

On August 23, 2010, Mr. Parker sent a "memo on 404(c)" to Ms. Steiner-Riley stating:

> In the preamble that accompanies adoption of 40 CFR Part 231, which implements Section 404(c), EPA expressed its preference for comprehensive advance prohibition whenever appropriate. I am attaching a memo. It asserts that, based on this preference and a host of other reasons, EPA has a responsibility to propose such a comprehensive approach with respect to metallic sulfide mining in the Kvichak and Nushagak drainages of southwest Alaska. **[Ex. 46]**

Ms. Steiner-Riley followed up by arranging to talk to Mr. Parker about the issue.

Mr. Parker's next flurry of emails came in January 2011. On January 14, 2011, he replied to an EPA recipient (whose name is redacted) concerning the *Rapanos* case (interpreting the Clean Water Act's definition of "waters of the United States"). **[Ex. 47]**

On January 16, 2011, he wrote Steiner-Riley, saying, "I meet with the Tribes on Wed and Thurs. Do you have a few minutes on Tues to brief me on the status of the Tribes' 404(c) request." **[Ex. 48]** On March 18, 2011, Parker wrote again to a recipient (whose name is redacted) making a case for EPA to put four tribal reps, rather than three, on the inter-governmental task force. **[Ex. 49]** On August 23, 2011, Parker wrote North advising him to check out dust containment provisions for the mine. Parker then forwarded the email to a recipient whose name is redacted. **[Ex. 50]** On September 9, 2011, Parker wrote to a recipient whose name is redacted: "Are you available for a two-minute phone call?" **[Ex. 51]**

Then on September 21, 2011, Mr. Parker sent two reports to North at his "Phil and Amanda" home address and then forwarded the material to Palmer Hough. I discussed these reports in a previous letter to you. Parker sent his own 7-page draft "History of Conservation and Land Use Planning Efforts in the Kvichak and Nushagak Drainages." The other document is a 6-page formal memo entitled, "Assuming that EPA makes a 404(c) determination regarding the Kvichak and Nushagak drainages, what can make it stable under future federal administrations?" These memos show just how closely EPA was working with him and the 404(c) advocates. The depth of the collaboration is stunning.

On February 14, 2012, Mr. Parker showed concern that EPA was not moving fast enough on its 404(c) determination. He wrote Hough, Parkin and North proposing a plan for "how to speed up the current process for the watershed assessment and any 404(c) determination." **[Ex. 52]**

Mr. Hough wrote back: "We appreciate your thoughts regarding the schedule for our watershed assessment and any potential future actions. We will take these under advisement." **[Ex. 53]**

On March 20, 2012, Mr. Parker sent someone at EPA – the name is redacted – a copy of a March 9 letter from the Alaska attorney general. **[Ex. 54]** On April 10, 2012, Parker sent North, Steiner-Riley and Hough a 2-page memo about a new law review article:

> I hope you and others in EPA will find the attached law review article helpful. It is titled: "Section 404(c) of the Clean Water Act and the History of State and Federal Efforts to Conserve the Kvichak and Nushagak Drainages of Alaska." I am the author. Please feel free to copy, distribute or use as you and others see fit. **[Ex. 55]**

Ms. Steiner-Riley responded: "Thanks, Jeff!" **[Ex. 56]**

10. Shoren Brown, Trout Unlimited: 2010

On March 24, 2010, Shoren Brown emailed ARU manager Michael Szerlog, saying, "I would like to catch up with you on a number of CWA issues at Pebble." They agreed to talk March 26. **[Ex. 57]** On April 1, Brown asked to meet with Szerlog and they set a meeting for April 6. **[Ex. 58]** Two weeks later, Brown was back in Washington, D.C. to meet with EPA officials there. **[Ex. 59]**

On June 1, 2010, Mr. Brown emailed North saying, "If you're in town, I'd love to catch up." **[Ex. 60]** This was the first such email in the FOIA record between the two, but obviously they had been communicating. North replied, "Hi, Shoren, I will be in Seattle to brief the RA Sunday through Thursday. Maybe next time."

On June 11, 2010, there were several exchanges between Brown and EPA. First, Brown asked North for "a time to talk so I can update you on upcoming events." North then issued an extraordinary invitation to Brown: "Would you like to come into the field for some research training. We are starting a research project on wetland hydrology. The graduate student who will do most of the work is training a couple of us on collecting data. That will take all day. Otherwise, could we get together in the evening?" **[Ex. 61]**

Mr. Brown then contacted Kendra Tyler, an assistant to the Region 10 administrator, to set up yet another TU briefing. **[Ex. 62]**

Mr. North reported back to Mr. Brown on his briefing to the regional administrator: "We briefed Dennis [McLarren] this past Tuesday. There was a somewhat large crowd, many of whom had not had a briefing. It seemed to go well. I think they understand at least the resource issues." **[Ex. 63]** This was the June 2010 briefing mentioned above.

On June 14, 2010, Mr. Brown emailed a "404c summary" to North, saying, "Phil – this is still in draft form but I thought you might find it informative. I'll make sure and send the final when it's complete." The summary, called "Projects Vetoed Updated" was not included in the FOIA record, and the email shows it was deleted from the reply by North, who answered: "Thanks Shoren. I will look it over. It looks like you will meet with staff in the morning for technical discussions and Dennis in the afternoon. I am hoping to be on the phone for the Tuesday morning technical discussions." **[Ex. 64]**

The next Trout Unlimited briefing occurred at Region 10 headquarters on June 22, 2010, and included several other ENGO 404(c) activists: David Chambers of the Center for Science and Public Participation; Lydia Olympic of The Wilderness Society; Bob Waldrop of the Bristol Bay Regional Seafood Development Association; Tim Bristol, Trout Unlimited Alaska Director; and Shoren Brown. **[Ex. 65]** Brown later sent Chambers' PowerPoint presentation to North. **[Ex. 66]**

On July 16, 2010, Mr. Brown sent a revealing email to Szerlog, copied to North, saying he wanted to talk about the upcoming visit to Alaska by the high-ranking EPA delegation, including Administrator Lisa Jackson. "There are some negative rumors circulating within the tribes and other interest groups working on pebble about the upcoming EPA trip to Alaska. I am happy to help out and circulate the correct information for you to these stakeholders if you would like. Quite frankly – *I am worried that some people may go public and damage TU's ongoing efforts and the productive relationships that have been established to date.*" (emphasis added) **[Ex. 67]**

On July 22, 2010, Mr. Brown sent an email that appears to be Tami Fordham (the addressee is redacted) who was working on arrangements for Region 10 and the EPA trip, saying, "Thanks for the update. Things are looking good from our end. I got your message re media. We are working to keep quiet honestly but if we do find out the press is coming – I will pass on who and when they plan to arrive." **[Ex. 68]** EPA was making Brown privy to EPA's plans.

On July 23, 2010, Mr. Brown accepted an invitation to meet with Nancy Stoner, the assistant administrator for water at EPA headquarters, and a former co-director of the water program for the Natural Resources Defense Council. **[Ex. 69]**

Mr. Brown and Mr. North kept up their dialogue as well. On October 22, 2010, Brown sent North a "Pebble ecological risk assessment" from The Nature Conservancy and offered to connect North with the report's authors. **[Ex. 70]** A week later, on October 30, 2010, North invited Brown "and his scientist" to come to Soldotna to meet with him. **[Ex. 71]** North accepted Brown's offer to put him together with The Nature Conservancy to discuss the risk assessment and on December 10, 2010, they made plans to meet. **[Ex. 72]** A week later, on December 18, 2010, Brown was asking North and Palmer Hough to arrange more TU briefings for early 2011. **[Ex. 73]**

11. Trout Unlimited Seeks to Discredit Native Corporation Science

On November 1, 2010, Shoren Brown emailed unknown EPA recipients (their names were redacted) seeking to discredit an Alaska Native corporation because it had a contract to conduct scientific studies for Pebble. "APC's subsidiary has financial ties to PLP," Brown wrote. **[Ex. 74]**

APC is a consolidated village corporation for South Naknek, Port Heiden, Ugashik, Kokhanok and Newhalen. All are in the Lake and Peninsula Borough except South Naknek, which is in the Bristol Bay Borough. The offending item from APC's June 2008 newsletter, which Brown quoted in the email, reads as follows: "APC continues to work at the Pebble site conducting hydrology, water quality and trout telemetry studies. During the month of May, APCS, including APC shareholders conducted hydrology studies and fish capture work in support of telemetry studies to learn the life cycles of trout that spawn in Upper Talarik." APCS makes no secret of its work and its web site lists its numerous science projects.[7] **[Ex. 75]**

Trout Unlimited attempted to discredit APCS for conducting telemetry studies of *trout*.

12. Attack on Mayor Alsworth

On December 4, 2010, the Lake and Peninsula Borough Mayor, Glen Alsworth, wrote a two-page letter to EPA Administrator Lisa Jackson asking her to withhold judgment on a 404(c) veto.

> On behalf of the Lake and Peninsula Borough, I am writing you to urge you not to use authority under Section 404(c) of the Clean Water Act to *preemptively* prohibit wetland fill within Bristol Bay. Such a move would disrespect science and could provide a death blow to our villages.
>
> ....
>
> **A Preemptive Decision Disrepects Science.** Tens of millions of dollars of scientific information has been gathered for the mine. Most of it has not been released to the public or to EPA. Some remains to be gathered. There is no reason to make a decision before the scientific information is available. EPA's 404 authority will be just as valid after the scientific information is available as it is today.

[Ex. 76] (Emphasis in the original)

On December 6, a consultant to the borough, Bob Loeffler, emailed the mayor's letter to Jackson and McLerran as well as to Parkin and McGrath with the subject line "Borough Letter concerning 404(c)." Parkin forwarded it to other EPA officials, including North and Hough. Within an hour, Hough forwarded it to Shoren Brown, "FYI." **[Ex. 77]**

---

[7] http://www.apcservicesllc.com/projects

On January 6, 2011, anti-Pebble activist John Holman wrote a page-long personal attack against Alsworth and sent it to both Jackson and McLerran, noting that it was in response to the mayor's letter. Holman said Alsworth was the subject of an investigation by the Alaska Public Offices Commission for not disclosing business connections to Pebble. Holman cautioned the EPA administrators against "taking much stock in Mayor Alsworth's personal opinions as he does not speak for the people he represents or the assembly." **[Ex. 78]**

In fact, Mr. Holman *himself* was the complainant and one of Robert Gillam's lawyers, Scott Kendall, filed the complaint with APOC. In March 2011, APOC dismissed the complaint. Alsworth, elected more than two decades ago, was reelected to a new three-year term in 2012 by a 3-1 margin against a Pebble opponent.

In 2008, Mr. Holman served as treasurer for the Clean Water Initiative largely funded by Gillam. He is the president of Bristol Bay Forever, which is sponsoring a new anti-Pebble initiative. He is a director of the Renewable Resources Foundation, founded by Gillam and which is the only other source of funding for the Bristol Bay Forever initiative besides Gillam. Holman is also the owner of the No See Um Lodge overlooking the Kvichak River.

13. Robert Waldrop

Robert Waldrop was executive director of the Bristol Bay Regional Seafood Development Association representing commercial driftnet fishermen. Until October 2013, Mr. Waldrop also served as vice president and board member of the environmental law firm Trustees for Alaska, which represents the ENGO Nunamta Aukulestai in suits to halt the Pebble project. And until January 2014, Waldrop was president of the Trustees for Alaska Endowment Fund. Waldrop currently serves as treasurer and was president of another ENGO called Alaska Salmon Initiative. He has also been active in an entity called the Bristol Bay Working Group.

EPA took him into the fold with other favored ENGO leaders. Before long, EPA was looking to Mr. Waldrop along with Shoren Brown of Trout Unlimited as useful 404(c) advocates.

On June 20, 2010, Mr. Waldrop wrote EPA Administrators Jackson and McLerran asking that EPA use its 404(c) powers to intervene to stop the mine without waiting for details on Pebble. **[Ex. 79]**

Mr. Waldrop attached a 7-page document entitled, "The Justification for Preemptive Use of CWA 404(c) to Protect Alaska's Bristol Bay Watershed." He acknowledged that "EPA may need more information," but still argued for action based on the potential for unacceptable adverse impact.

Mr. Waldrop said, "We are committed to working with USEPA as it moves forward in the Pebble Mine 404(c) process." Indeed, Waldrop would become a key player in the unfolding campaign, meeting with EPA officials from Alaska to Washington, D.C. and working with Trout

Unlimited's Shoren Brown to persuade the U.S. Fish & Wildlife Service to support an EPA veto. It was EPA itself that began opening the FWS doors for Waldrop and Brown.

Although Mr. Waldrop mentions fisheries (he heads a fishermen's group), his 7-page "Justification" to EPA has only a limited focus on the salmon resource. Waldrop provided his paper to one of his grant funders, the Gordon and Betty Moore Foundation, which donates millions of dollars to the Bristol Bay cause. The foundation's Wild Salmon Ecosystem manager Aileen Lee provided a copy to Michelle DePass, Assistant Administrator for Tribal and International Affairs at EPA headquarters prior to her trip to Alaska with Jackson.

Mr. Waldrop also wrote DePass on July 23, 2010 and said, "Recently, I was with a small group that met with EPA Regional Administrator, Dennis McLerran, and his staff to discuss possible 404c action concerning proposed mining development in the headwaters of two major salmon rivers in the area." **[Ex. 80]**

Mr. Waldrop's brief description of his meeting with McLerran was emblematic of the way EPA and ENGOs were coming to cooperate – private meetings between a small group of ENGO 404(c) advocates and a small group of EPA policy makers with the power to grant their 404(c) request. Meetings like the one Waldrop described would grow in frequency and intensity – all one-sided, all out of the public eye and generally unknown to any other interested parties such as Pebble, the State of Alaska, local governments and anyone with a contrary view.

Like Parker and Brown, Mr. Waldrop kept information flowing to EPA. And like many of these messages, EPA redacted the recipient. For example, on October 20, 2010, Waldrop wrote a redacted recipient with this subject line: "Bristol Bay Commercial Fishing request to initiate 404c of CWA." Waldrop's email said: "If we can help deepen your understanding of the fishery or of the region as a whole, please let us know." **[Ex. 81]**

On February 7, 2011, after EPA announced its plans for the watershed assessment, Mr. Waldrop wrote an appreciative email to someone in EPA (the name was redacted). "Thanks for your role in crafting and getting this issue to front and center." Waldrop also asked for advice on how to connect with McLerran in Anchorage, where he was speaking at the Alaska Forum on the Environment on February 8, "so I and a native leader (not a crowd) may look him in the eye and say 'thank you.'" **[Ex. 82]**

14. Wayne Nastri, Lobbyist

By the fall of 2010, lobbyist Wayne Nastri, who was the EPA Region 9 Administrator until 2009, was working for many of the 404(c) advocates and getting them inside the doors at EPA.

There are an enormous number of emails to and from and referring to Mr. Nastri in the FOIA record production. Many are repetitive because he would send almost identical individual emails to EPA officials to set up separate meetings. He became a constant presence in the EPA

process and his stable of activists came to include Brown, Waldrop, former state legislator Rick Halford, Parker's tribal clients, NRDC lawyer Joel Reynolds, and others.

Mr. Nastri's voluminous communications make it appear that he got every audience he requested, whenever he asked for it, and for whomever he had in tow to advocate for a section 404(c) veto. Nastri obtained special access for anti-mine activists, fostering their special relationship with EPA that was afforded only to the mine opponents.

For example, on September 3, 2010 Mr. Nastri sent Mr. McLerran the following email. "As you know the broad-based coalition [Nastri's clients] concerned about Pebble mine will be in Washington, DC Sept. 21-23 and is hoping to meet with several people at USEPA including Pete Silva, Michelle DePass, Bob Sussman, Scott Fulton, and Bob Perciasepe. I want to make sure you know about this as I will be requesting the meetings early next week. I want to check in with you and see if you have any concerns. I am aware that many of the stakeholders have spoken with you and the Administrator and the last thing I want to do is put you in an uncomfortable position." **[Ex. 83]**

Mr. McLerran replied: "Wayne: thanks for the heads up on this. Your timing on this is good. We are very actively discussing this issue at the moment so talking to headquarters folks is very timely."

Mr. Nastri then worked on arranging for meetings in Washington, D.C. The response, from Bob Sussman, senior policy counsel to the Administrator, set the tone: "Hi Wayne. Of course, I remember you from your RA days. We would be happy to meet with the coalition. I'd like to line up representatives of OW and OGC to join the meeting and to have R10 participation by phone." **[Ex. 84]**

Mr. Nastri was also setting up separate, individual meeting with top EPA officials. Afterwards, Nastri went back to McLerran for a debriefing. **[Ex. 85]** By the end of year, Nastri was setting up more meetings, and he had added another ENGO client, The Nature Conservancy. **[Ex. 86]**

On February 2, 2011, Mr. Nastri arranged a technical briefing for EPA's Watershed Assessment team. The briefing Nastri arranged was by two more former EPA colleagues he enlisted: William M. Riley and Thomas G. Yocom. Mr. Riley retired from EPA in 2007, after working on environmental assessment, wetlands, mining and aquatic resources in Region 10. Mr. Yocom retired from EPA is 2005 and also worked for the U.S. Fish and Wildlife Service. They became permanent and regular players in the 404(c) process from that point forward, with Nastri making arrangements.

On February 7, 2011, Mr. McLerran notified Mr. Nastri (among others) by email of the Bristol Bay Watershed Assessment, sending along the press release and an outline for the assessment. **[Ex. 87]** One week later, on February 14, 2011, Nastri arranged two science briefings for EPA. Nastri, Brown and Waldrop attended both. **[Ex. 88]**

On May 31, 2011, Mr. Nastri helped prepare Mr. McLerran for a trip to Bristol Bay. "I just want to wish you a safe and productive trip as you visit the Bristol Bay area. Also, I know you will be well-briefed and prepared to answer many questions. Here are some questions though that you may be asked in your meetings." **[Ex. 89]**

Mr. Nastri's questions -- How long will it take EPA to reach its decision? What comes after the assessment? What is necessary for EPA to make a finding sufficient to trigger a 404(c) action? and others – were posed just as if he were McLerran's assistant. And McLerran thanked him in the same vein: "This is helpful for our presentation."

Mr. Nastri continued to set up countless briefings and connect with EPA and ENGO representatives. An email exchange between Mr. Nastri and Mr. Sussman on March 9, 2012, might be typical for summing up their relationship. Nastri told Sussman: "Thank you for taking the time to meet with representatives of the Bristol Bay Native Association, Bristol Bay Native Corporation and Trout Unlimited yesterday afternoon. As we mentioned, we are very appreciative of all the work the Agency is doing for Bristol Bay and it's [sic] residents."

Mr. Nastri said, "We will continue to work to support the Agency's effort by providing technical information, where possible and appropriate, and through our continued outreach to local state and federal stakeholders. We will also continue to keep you apprised of our efforts."

Mr. Sussman's reply: "Wayne. Pleasure to work with you on this." **[Ex. 90]**

15. ENGOs Inside EPA Headquarters With Nancy Stoner

One of the leading ENGOs fighting the Pebble project is the Natural Resources Defense Council. NRDC had an inside connection and ally at EPA headquarters, Nancy Stoner, Deputy Assistant Administrator for Water. For many years she was a senior attorney at NRDC and ran the water program there. Just a few months after Ms. Stoner went to EPA, her former colleagues at NRDC were at her door advocating 404(c) action. NRDC and EPA were actively engaged throughout the summer of 2010, according to FOIA records. These records show no such NRDC-EPA activity prior to this. *Only after Stoner was installed at EPA headquarters did NRDC move in to position at EPA.*

Most significantly, Ms. Stoner appeared to circumvent a ban on meeting with her prior employer by adding others to the anti-Pebble NRDC meetings. When NRDC attorney Joel Reynolds on June 14, 2010, asked Stoner for a 404(c) meeting, she replied, "I am not supposed to set up meetings with NRDC staff, but can attend such a meeting if there are enough others in attendance." **[Ex. 91]**

In requesting a meeting, Reynolds told Ms. Stoner that Shoren Brown of Trout Unlimited would be the lead contact, thus smoothing the way for what would appear to become Ms. Stoner's open-door policy in welcoming the ENGOs to EPA. More than a mere open door-policy, Stoner herself invited anti-Pebble ENGOs to meet. On July 21, 2010, she invited Jan

Goldman-Carter of the National Wildlife Federation to join a meeting she had scheduled with Trout Unlimited. **[Ex. 92]** The meeting took place in Stoner's office on July 23. **[Ex. 93]**

Ms. Stoner and Goldman-Carter, Wetlands and Water Resources Counsel at the NWF National Advocacy Center, clearly had a close working relationship and Bristol Bay 404(c) issue was part of it. On August 3, 2010, EPA Office of Water Chief of Staff Gregory Peck wrote Stoner and two other top EPA officials about a bill introduced by Alaska Congressman Don Young that would strip EPA of its 404(c) powers. Stoner forwarded the email to Goldman-Carter with the message "while I'm thinking about you – fyi." **[Ex. 94]**

Meanwhile, the NRDC lawyer in Ms. Stoner's old job in the NRDC water program, Jon Devine, on August 5, 2010, initiated contacts between NRDC and other top EPA officials. EPA's Bob Sussman replied, "Happy to set this up, Jon." **[Ex. 95]**

On September 23, 2010, Ms. Stoner was among a group of top EPA officials meeting to discuss "pre-emptive CWA 404(c) action near Bristol Bay" with Wayne Nastri, Shoren Brown, Bob Waldrop, Rick Halford and several others. **[Ex. 96]** After the meeting, Mr. Brown asked for – and was granted – follow-up time with Ms. Stoner "to discuss upcoming activities we are planning." **[Ex. 97]**

On October 20, 2010, EPA Water Chief of Staff Peck wrote Stoner that he was setting up a call to discuss Pebble with National Wildlife Federation lawyer Tony Turrini who asked "to hear more about EPA's strategy for dealing with hard rock mining discharges and to discuss ways in which we can support effort." **[Ex. 98]**

With Shoren Brown often acting as front man for the ENGOs, Ms. Stoner was a major player, her attendance required by EPA and sometimes even chairing the meetings, such as one on October 25, 2010. **[Ex. 99]**

Ms. Stoner continued to be a major player, meeting with ENGOs, leading conference calls, such as on March 29, 2011 **[Ex. 100]** and visiting Alaska.

16. Propaganda Trumps Science: ENGOs Flood EPA with Politics of Persuasion

EPA's stated role was to "conduct a scientific assessment," as it announced on February 7, 2011. Science is supposed to be unbiased, but EPA welcomed a virtual flood of propaganda from anti-mine activists. The ENGOs, between preparing one-sided reports by partisan scientists for EPA-eyes only, and conducting innumerable private briefings for EPA, were flooding EPA with material far removed from science. Trout Unlimited led the non-scientific information onslaught – and EPA fully embraced it.

ENGOs filled EPA inboxes with an incredible array of non-scientific material, a mix of political and partisan advocacy along with news accounts of the anti-Pebble campaign. This

material covered everything from churches to chefs, from jewelers to "jammin' for salmon" festivals, from the ENGO's Bristol Bay action plans to bumper sticks opposing Pebble.

Not only did EPA accept, and even invite, this information, EPA often took it upon itself to further distribute this vast trove of ENGO material—including the 404(c) advocates' press releases—within EPA itself.

On September 14, 2010, TU's Shoren Brown sent an email to Region 10 Administrator Dennis McLerran called "Here comes the foodies …" **[Ex. 101]**

On September 20, 2010, TU's Shoren Brown sent Mr. North and his Aquatic Resources Unit boss Mr. Szerlog a letter that Tiffany & Co., the jeweler, wrote to EPA opposing Pebble. "Just wanted to make sure it crossed your desks," Brown wrote. **[Ex. 102]** (Tiffany & Co. went on to give Trout Unlimited's Bristol Bay Protection Campaign, which Brown directs, a $350,000 grant. Tiffany also funded the study that Trout Unlimited provided exclusively to EPA under an embargo until it was released months later.)

On October 25, 2010, Tyler Edgar, Climate and Energy Campaign Manager for the National Council of Churches, sent two items to Brown: a letter opposing Pebble from the churches' own ENGO, the Eco-Justice Program, to Administrator Lisa Jackson along with a separate resolution from the Russian Orthodox Diocese of Sitka, Anchorage and Alaska. Brown dispatched the items to Ms. Stoner and others at EPA. Stoner in turn forwarded the church statements to additional unknown (redacted) EPA recipients. The churches cite no scientific studies, but urge EPA "to initiate a 404(c) process to ensure protection for God's Creation and people in Bristol Bay." **[Ex. 103]**

"Specifically, we urge you to initiate a 404(c) process as outlined under the Clean Water Act which would outline the impacts of the mine's waste on the area's water quality, a vital component of God's creation, and prevent the use of the Bristol Bay watershed as a dumping ground for toxic mining waste," the churches' letter said.

Trout Unlimited considered the undated Russian Orthodox Diocese resolution sufficiently anti-Pebble to make sure it landed at EPA headquarters.

On February 4, 2011, the same Tyler Edgar, who serves as associate director for the church Eco-Justice Program, wrote directly to Phil North and Palmer Hough to inform them of an event in January when Russian Orthodox Bishop Benjamin journeyed from San Francisco to Bristol Bay for a "Blessing of the Waters." Edgar posted the item on the eco-justice program web site **[Ex. 104]** as did other anti-Pebble groups. The bishop's transportation to Bristol Bay was provided by anti-Pebble financier Robert Gillam, who owns nine private planes, and who was wooing the Russian Orthodox Diocese to his cause. It was later revealed that Father Michael Oleksa – the Alaska diocese leader who arranged the visit as he and Gillam courted each

other – had anticipated substantial payback from Gillam in return for the church's anti-Pebble efforts.[8]

On February 17, 2011, Palmer Hough sent an email to a dozen of his EPA colleagues, saying: "Folks: FYI, in case you have not heard March will be a big communications month for the coalition calling for a 404(c) action in Bristol Bay." And then he went on to highlight some of the events. **[Ex. 105]** The ENGOs did not have to work as hard to spread their message and announce their events when EPA officials themselves were doing the job. Moreover, the events had nothing to do with science, but were all about the political efforts of sportsmen, churches, chefs and others to win adherents – and dishing up salmon at receptions.

On March 29, 2011, Trout Unlimited Alaska Director Tim Bristol sent Stoner and other EPA officials a press release and letter from "chefs, restaurateurs and food lovers" urging EPA to use its 404(c) authority to stop Pebble. Twenty restaurants announced they would serve Bristol Bay salmon for one week "demonstrating the culinary value" of the fishery. **[Ex. 106]**

Trout Unlimited started sending weekly media reports to EPA officials making sure every anti-Pebble article, press release and announcement landed on EPA desks. EPA apparently went to a lot of trouble to protect the recipients from disclosure by redacting names from these emails. However, by simply scrolling to the bottom of the email, one can see the recipient's name, as in this April 5, 2011 "Bristol Bay Media Round Up" to Nancy Stoner. **[Ex. 107]** That is often how such mass emailings work, but EPA's FOIA redaction person must not have been aware of that.

A sampling of other weekly email news from Trout Unlimited – sometimes called "Save Bristol Bay in the News" or simply "Bristol Bay in the News' – include the following: November 8, 2011 to Cara Steiner-Riley **[Ex. 108]**; November 14, 2011 to Michelle DePass **[Ex. 109]** ; November 21, 2011 to Michael Szerlog **[Ex. 110]**; December 20, 2011 to Phil North **[Ex. 111]**; and August 6, 2012, which includes an article about "jammin' for salmon." **[Ex. 112]**. These emails also went to Bob Sussman, Palmer Hough, Julia McCarthy, Bill Dunbar and other EPA officials.

By the end of 2011, so much Trout Unlimited email was pouring into EPA inboxes that servers identified it as "POSSIBLE SPAM" as shown in emails on November 9 and December 6, 2011.**[Ex. 113]** But the flood continued.

Typically mass emails offer recipients an opportunity to unsubscribe or opt out, and that was true here, as the last page of these mailings indicates. The fact that these EPA officials chose *not* to opt out indicates that they welcomed this regular flow of mostly anti-Pebble news from the Trout Unlimited media machine.

EPA, like many agencies, sends out news relevant to the agency and its employees. EPA had what it called its "E-Clips" service as in this sample from July 28, 2010. EPA also provided

[8] http://www.alaskadispatch.com/article/pebble-opposition-finds-religion

special internal coverage after events such as the February 7, 2011 watershed announcement. **[Ex. 114]** Apparently, Trout Unlimited did not trust EPA to make sure all the appropriate people received everything Trout Unlimited deemed important, whether it involved science or not. Thus, the Trout Unlimited-EPA weekly service kicked in.

In some cases, EPA officials themselves distributed announcements for Trout Unlimited and other ENGOs. Frequently, they had little or nothing to do with science and lot to do with ENGOs themselves. For example, on April 12, 2012, Palmer Hough emailed a long list of fellow EPA officials with an "Updated letter from Sportsmen for Bristol Bay" supporting the 404(c) action. However, the letter was not much of an update because it was identical to the one sent 14 months earlier (in February 2011). Mr. Hough took it upon himself to send it to more than two dozen EPA officials simply to show the additional signatories. **[Ex. 115]**

On April 17, 2012, Shoren Brown sent out mass emails reminding EPA officials of the Sportsmen for Bristol Bay reception, such as this message to Ms. Steiner-Riley. **[Ex. 116]** But EPA got the reminder out first. On April 16, Scott Fraser of EPA's Office of Public Engagement thanked EPA officials for participation in an ENGO event that day and told the EPA headquarters staff, "Tomorrow, the sportsmen are hosting a reception at the Hart Senate Office Building (Room 902) and you are welcome to attend (no RSVP is required." **[Ex. 116]** However, this was not a mere reception as the EPA email would indicate. As an April 10, 2012 email from Shoren Brown makes perfectly clear, this was an anti-Pebble event to "talk with prominent Bristol Bay stakeholders from across the country as you learn about the fight to protect Bristol Bay, Alaska and America's hunting and fishing legacy." **[Ex. 117]** No matter, EPA told its top officials they "are welcome to attend."

Trout Unlimited emails to EPA officials even included an April 10, 2012 email from Shoren Brown – recipient redacted but addressed to "SBB Prospect-588" (SBB referring to Save Bristol Bay) – with the subject line: "Show your support with No Pebble Mine stickers." The email said, "We've got a great opportunity for you to show your support for Bristol Bay and wear it on your sleeve, bumper or wherever else you fancy.' **[Ex. 118]**

Ironically, EPA had been showing its support – privately and internally – for a Bristol Bay 404(c) action for almost four years at that point, going back to North's earliest efforts in 2008 to launch the 404(c) process.

17. Lydia Olympic of The Wilderness Society

The FOIA records produced dozens of emails for 2010 between EPA and various local government officials, including tribal councils, in the Bristol Bay region. Much of the communication was mundane and involved meetings, tours and planning. Some emails have large redactions among the address block. But wherever the addressees are readable, one name stands out: Lydia Olympic, a staff member for The Wilderness Society, not only the sole environmental group representative on the list, but perhaps the only Anchorage resident who regularly received these Bristol Bay emails. **[Ex. 119]**

Various ENGOs were working closely with EPA by this time, but only The Wilderness Society is included in many of these communications. Of course, Trout Unlimited, the Natural Resources Defense Council and other ENGOs and their principals preferred to work privately through their own well-developed channels. Ms. Olympic would later join some of the group meetings between other ENGOs and EPA.

Ms. Olympic clearly had a special relationship with EPA. She was among a handful of people included in emails from Tami Fordham with the subject line: "EPA Administrator Lisa Jackson Visit to Dillingham – Let's Plan this Together." **[Ex. 120]**

Ms. Olympic served on the EPA Tribal Operations Committee from 1999 to 2007 and worked on creating a Tribal Mining Advisory Committee. In 2009, EPA Region 10 gave her the Daniel Ellanak Environmental Excellence award for her work. Although she is a former village council member and a former Bristol Bay resident, her work with EPA during this period was as a staffer for Anchorage office of The Wilderness Society, and EPA embraced her participation.

In its annual report for *2010*, The Wilderness Society seemed to give Olympic a measure of credit for the EPA decision to conduct a watershed assessment even though that decision was *not announced until 2011*. The 2010 report states: "Lydia Olympic is leading our effort and is building strong public opposition. In response, EPA decided to conduct a watershed analysis to determine the mine's potential impacts." **[Ex. 121]**

The Wilderness Society report described Olympic's job as educating tribes and federal officials about Pebble's threats to fish. The report describes Olympic as "such a fervent opponent of the mine that she became known as 'the Pebble Rebel with a Cause.'" What makes that sobriquet interesting is that there are some EPA emails that include a recipient called "pebblerebel," sometimes unredacted, sometimes visible through an imperfect redaction. **[Ex. 122]** "Pebblerebel" obviously held a special insider position with EPA.

Oddly, despite Ms. Olympic's Wilderness Society role in educating federal officials (as the Society described her job) EPA produced no emails at all from Ms. Olympic to EPA.

18. Stark Contrast: EPA treatment of Pebble CEO John Shively

The above discussion illustrates how quickly EPA responded to ENGO requests for meetings, calls, briefings and information. By contrast, consider this exchange between Pebble CEO John Shively and Region 10 Administrator Dennis McLarren.

On January 31, 2011, Mr. Shively wrote McLerran inquiring about the status of the 404(c) petition:

> Dear Regional Administrator McLerran:
>
> When we met last month, you suggested I check in with you from time to time to discuss where EPA is with the 404c petition concerning Bristol Bay.

If you have some time this week, perhaps we could set up a call." **[Ex. 123]**

Mr. McLerran responds, copying four other top-ranked EPA officials: "I'll ask my staff to set up a call. I also plan to be at the Alaska Forum next week and perhaps we could talk there too." McLerran was referring to the annual Alaska Forum on the Environment, which was scheduled for February 7-11, 2011, in Anchorage.

One week later, on February 7, 2011, Mr. Shively again wrote Mr. McLerran: "Dennis, I have not heard back from your staff on whether they want to set up a teleconference this week or a meeting. I am in Anchorage only on Friday."

Unbeknownst to Mr. Shively, EPA had already made an important decision about Pebble that Mr. Shively had not been told about. On that very day, Monday, February 7, EPA would announce that it was undertaking the 404(c) Bristol Bay Watershed Assessment. The next day, Tuesday, February 8, 2010, McLerran spoke to the Forum. Apparently, the announcement and his speech were geared to the annual event. In the week leading up to this announcement, EPA withheld this information from Mr. Shively. The ENGOs were insiders; Mr. Shively was an outsider who was kept in the dark.

19. EPA Embraced Anti-Pebble ENGOs While Excluding Other Stakeholders

The large, if incomplete, EPA record released under the FOIA request is devoid of any evidence that EPA sought to obtain participation of *pro*-Pebble stakeholders, or even Alaska state agency personnel, in any discussions of the kind described above between EPA and the ENGOs.

ENGOs flooded EPA with emails focusing on the fight against Pebble. ENGOs privately provided EPA with report after report to support their position. None of this information was contemporaneously shared with Pebble or with any other stakeholders. EPA even excluded the landowner—the State of Alaska—until almost the eve of its public announcement as described in the section below.

The countless communications, calls and meetings between EPA and the ENGOs ignore all other stakeholders. The voluminous FOIA production shows that EPA was uninterested in engaging anyone but the anti-Pebble side.

Although EPA answered emails from other stakeholders, it never took steps to include them in its deliberations. In contrast, the anti-Pebble ENGOs were warmly welcomed. EPA demonstrated no inclination to bring balance—or even other viewpoints—to any of the many meetings EPA held with the ENGOs. The record shows they were all one-sided affairs, which speaks volumes about EPA's own view of its mission.

20. EPA Briefed Alaska on 404(c) Months after Working with ENGOs

While EPA busied itself with the ENGOs in private, it largely ignored the State. After months of working together with ENGOs on the 404(c) process, a November 24, 2010 email shows that EPA had finally set up an "audio-visual conference regarding 404(c) petition" for State officials.

However, this briefing was only about the tribes' petition, not about EPA's plan to go down the 404(c) path. What ENGOs had known for months – that EPA was embarking on a 404(c) veto – would not be revealed to the State until January 4, 2011. This was one month before the EPA announcement, but it was 2 ½ years after North initiated the 404(c) process and long after ENGOs were brought into the private EPA planning process.

On January 4, 2011, EPA Pebble project manager Richard Parkin emailed the Alaska Commissioner of the Department of Environmental Conservation Larry Hartig a message with this long, cautionary subject line: "Confidential *** Draft Outline of a Bristol Bay Process to inform EPA's decision whether to invoke 404(c) *** please don't distribute."

"I am sharing this with you before any other partners," Mr. Parkin said, even though EPA had already briefed many ENGOs, the FWS, and the NPS, about the 404(c) process. "Please ensure that it is not distributed. At this time it is too vulnerable to misinterpretation and speculation." So while EPA seemed to be comfortable sharing *everything* with ENGOs, it was very careful about sharing *anything* with anyone outside its inner circle—even the State of Alaska.

Mr. Parkin said EPA wanted to work with the State "to ensure that the proper information is reviewed and that the partners and stakeholders have an opportunity for meaningful involvement." Parkin did not reveal that EPA had long been working with anti-Pebble ENGOs and reviewing information from *them* to the exclusion of input from any other stakeholders, including the State.

Mr. Parkin followed up with Mr. Hartig by phone and later emailed him with permission from McLerran "to share the outline with your state counterparts." The record reveals nothing more about this EPA-State contact.

Conclusion

The foregoing review of the heavily redacted and incomplete set of emails produced by EPA provides a wider glimpse of how EPA privately engaged in a close working relationship with avowed Pebble opponents to develop a veto strategy. This review provides more evidence that the Final Assessment was written to justify a predetermined goal: a preemptive veto of the Pebble Project.

A biased report and biased process violate the Information Quality Act ("IQA") and the OMB and EPA guidelines promulgated pursuant thereto. Section 515 of the IQA directs federal agencies to maximize "the quality, objectivity, utility, and integrity" of the information they

create, collect, and disseminate. 44 U.S.C. § 3516 note. According to the OMB guidelines, "objectivity" requires disseminated information to be "unbiased." Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies, 67 Fed. Reg. 8452, 8453 (Feb. 22, 2002).

The Pebble Project is among the most significant mineral deposits ever discovered. EPA has long been secretively developing its strategy for preventing this deposit from providing the jobs and other economic benefits it is capable of producing. We ask you to investigate this matter.

Sincerely,

Richard E. Schwartz
Attorney for Northern Dynasty Minerals Ltd.

EXHIBIT H

FY11 Proposed Investment: **Bristol Bay 404(c)**

Funding Gap = $312k

Activity/Proposal: Initiate the process and publish a CWA 404(c) "veto" action for the proposed permit for the Pebble gold mine in Bristol Bay, AK.

Background: EPA is on a fast track to evaluate the potential harm of a proposed gold mine to the natural resources of Bristol Bay, AK. The Bay is the largest sockeye salmon fishery on the Pacific Coast; the fishery itself is larger than the combination of all other Pacific Ocean fisheries, and provides income to residents and food to Alaskan native villages. The mine, if permitted, would be the largest gold mine in the US, and would generate six times the tailings as the current largest mine.

While resorting to exercising EPA's 404(c) authority is rare (only 12 actions since 1981), the Bristol Bay case represents a clear and important need to do so given the nature and extent of the adverse impacts coupled with the immense quality and vulnerability of the fisheries resource. Threat of impacts will also harm all other investment in Bristol Bay. Six Alaskan tribes and 14 other stakeholders have requested that EPA initiate a 404(c) veto based on their concerns that the mine would irreversibly adversely affect the fishery. Region 10 believes that additional information gathering and analysis must be completed in order to support a decision to formally initiate of 404(c). It's still possible that a veto will not prove necessary, but a decision to move forward has created the need for upfront analysis and outreach regardless.

Additional FY11 resource needs funds for travel to Anchorage and the permit site; and contractor support to conduct specific scientific/technical analysis on the characteristics of salmon resource, the ecological and economic significance of salmon, stressors and threats to watershed health, and success or failures of potential mitigative measures. This work will support a decision in June 2011 whether to proceed with the 404(c) veto. If yes, then additional resources will be needed in FY12 to issue the Recommended Determination, respond to comments, and issue the Final Determination by the summer of 2012.

Impact/Rationale: Given the magnitude of proposed project's environmental impact and the Administration's decision to proceed, we have no choice but to support this work.

Decisions to date/shortfall: Funding has already been provided for one SEE staffer in Region 10, along with $64k in FY10 funds to initiate the risk analysis. The work that EPA has already committed to (i.e., pre-404(c) activities) will require an additional $312k in the Region and HQ. Conduct of the 404(c) action itself (anticipated in FY12) will require an additional $187k.

	Subset of OW Priorities resource gaps identified at Management Retreat:		FY 11 Need Above Base	FY 12 Need Above Base	FY 11 FTE Need Above Base	FY 12 FTE Need Above Base
			Dollars in thousands			
1	Non-responsive [redacted]	[redacted]	[redacted]		[redacted]	
		[redacted]				
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		
[redacted]	[redacted]	[redacted]	[redacted]			
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]					
[redacted]	[redacted]				[redacted]	[redacted]
	[redacted]		[redacted]	[redacted]	[redacted]	[redacted]

OW Priorities resource gaps identified subsequent of the Management Retreat:

	Bristol Bay	OWOW	$312.0			
	Non-responsive [redacted]	[redacted]	[redacted]		[redacted]	
	[redacted]	[redacted]	[redacted]			
	[redacted]	[redacted]	[redacted]	[redacted]		
	[redacted]	[redacted]	[redacted]		[redacted]	
	[redacted]	[redacted]	[redacted]			
	[redacted]	[redacted]	[redacted]			
	Overall Total		Non- [redacted]	[redacted]	[redacted]	[redacted]

	List of Program Areas identified as Potential Sources of Resources for Priorities:		FY 11 Redirection	FY 12 Redirection	FY 11 FTE Redirection	FY 12 FTE Redirection
			Dollars in thousands			
1	Non-responsive [redacted]	[redacted]	[redacted]			
[redacted]	[redacted]		[redacted]			
[redacted]	[redacted]	[redacted]	[redacted]			
[redacted]	[redacted]	[redacted]				
[redacted]	[redacted]	[redacted]				
[redacted]	[redacted]	[redacted]	[redacted]			
[redacted]	[redacted]	[redacted]				
[redacted]	[redacted]	[redacted]	[redacted]			
[redacted]	[redacted]	[redacted]	[redacted]			
[redacted]	[redacted]	[redacted]	[redacted]			
[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	
[redacted]	[redacted]	[redacted]	[redacted]			
[redacted]	[redacted]	[redacted]				
[redacted]	[redacted]	[redacted]				
[redacted]	[redacted]	[redacted]				
	[redacted]		[redacted]			

EXHIBIT I

MEMORANDUM

November 17, 2013

JADE NORTH, LLC
Phone: 250-4621
E-mail: bobl@jadenorth.com

To: Lake and Peninsula Borough Assembly
Nathan Hill, Manager

From: Bob Loeffler

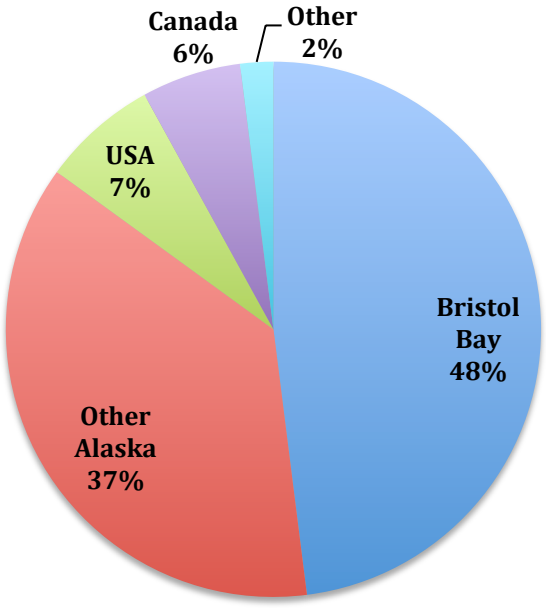
Subject: Economic Effects of Anglo's Pullout

Anglo's withdrawal form the Pebble Project is causing almost all of the Pebble Project employment in our Borough to at least temporarily end. This memo traces the economic consequence of the lost employment on our villages and citizens.

Employment — Bristol Bay Region. In 2012, a total of 1403 people worked on the Pebble Project at some time or another – 182 of these from the Bristol Bay Region. Many of these worked just a few days, and some worked all year. Based on hours worked, the employment equaled 244 full time jobs, of which 28% were from the overall Bristol Bay Region.

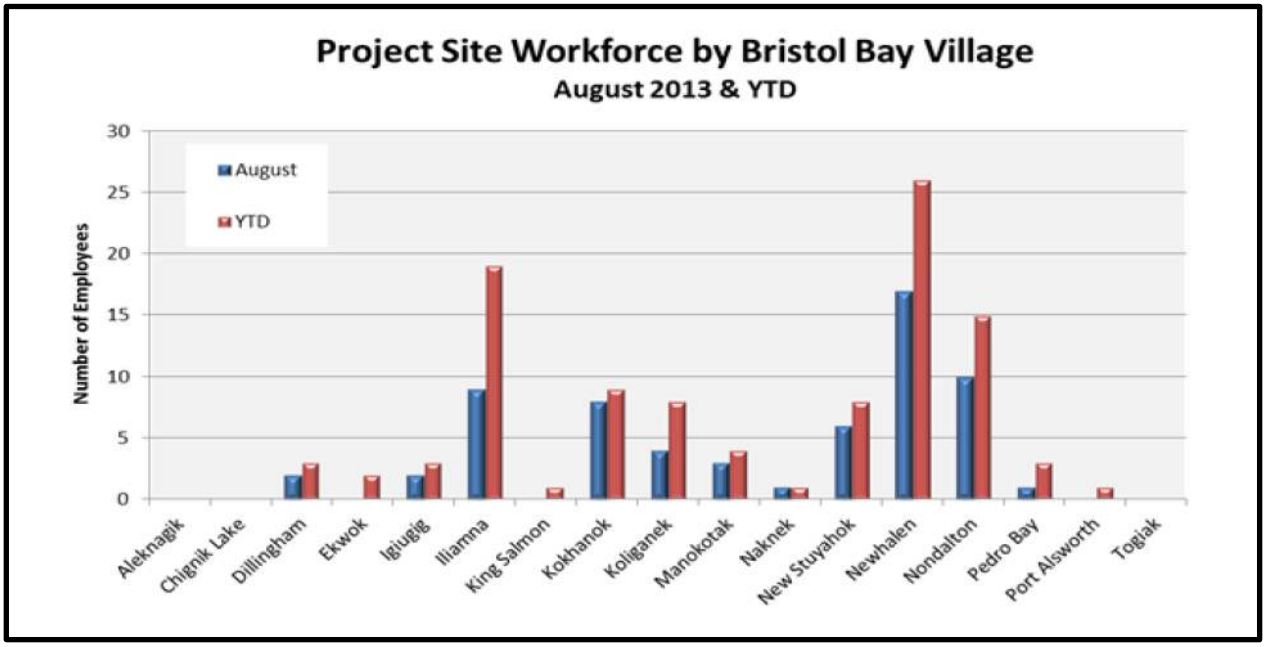
In 2013, there were far fewer employees overall (less than 350 through August), but a greater portion from Bristol Bay. In 2013, based on hours worked almost half were from the Region.

2013 (through August) Pebble Workforce, by hours worked
(Source Pebble Limited Partnership)



Employment — Lakes Region of the Lake and Peninsula Borough. The graph below shows employment from each Bristol Bay Village in 2013. It includes workers employed directly by Pebble and by Pebble's contractors. For the Lake and Peninsula Borough, the vast majority of Pebble-related employment was concentrated in Nondalton, Newhalen, Iliamna, and Kokhanok. Pedro Bay, Port Alsworth, and Igiugig provided a very few people, and the remaining villages supplied none.

Note that YTD means year-to-date. The table shows employees in August 2013, and employees that worked any time January through August 2013. Not all of these people worked full time – some may have for only a few days.



(Source: Pebble Limited Partnership)

Through August, 103 people from the Bristol Bay Region had worked at Pebble – of these 76 were from the seven villages of our Borough's Lakes Region: Igiugig, Iliamna, Kokhanok, Newhalen, Nondalton, Pedro Bay, and Port Alsworth. Figures are similar if one looks only at the August data. In that month, 63 people from Bristol Bay were working at Pebble and 47 (75%) of them were from the seven-village Lakes Region.

From other data, it appears that the August's work is equivalent to roughly 34 full-time jobs for residents of the Lakes Region.[i] In 2012, there was significantly more employment and the number of jobs would have been noticeably greater.

Income. In 2012, the total wage income that went to employees from the Lakes Region appears to be somewhere between $2 and $3.3 million. In 2013, the total wage income was likely half of that amount. To put it another way, to the extent income is shared in the villages, Pebble's exploration wages would have raised per capita income in the villages between $2,200 and $3,700 per year.

These are large numbers for small villages. To put it into perspective, according to the Alaska Department of Labor, the total wage income from all sources that went into the seven villages in 2011 was $10.5 million. Therefore, it in 2012, Pebble's exploration supplied between 20% and 30% of the wage income for these villages (though significantly less in 2011).

For the four villages that supplied most employment to Pebble, the proportion is higher. Iliamna, Newhalen, Nondalton, and Kokhanok supplied more than 90% of the employees that came from the Lakes Region. For these villages, Pebble's 2012 wages may have represented between 20% and 40% of all wages.

One last way of putting it into perspective. According to data on commercial fishing from EPA's 2012 draft watershed assessment, the 2010 economic effect of commercial fishing on the Lakes Region villages was only $1.4 million or $1,432 per person.[ii] Therefore, the effect of Pebble's exploration is significantly greater that that of commercial fishing for the Lakes Region villages. As one moves further from the Lake this effect will not be true: Pebble employment will be less and the effect of commercial fishing is greater.

Other Value. The numbers above do not include village contractors with Anchorages addresses and their joint venture partners (though they do include contractor employees who come to the Pebble site). Pebble paid $11 million to Anchorage-based village contractors. They also paid $2.7 million to other contractors – mostly air service operators – based in the villages (which does not include Lake Clark Air which has an Anchorage billing address).

A Cautionary Note. While most of data for this memo was provided by the Pebble Limited Partnership and is likely quite accurate, many of the calculations require some rough assumptions. Therefore, the conclusions should be taken as order-of-magnitude only.

---

[i] The similar number of full time jobs for all of 2013 for which data is available – January through August – indicates that, with some assumptions, employment was roughly equivalent to 20 full-time jobs from January 1st through the end of August. (Calculated by taking total person days for Bristol Bay Residents, assuming 75% were Lakes Region residents, and assuming 167 work days from Jan 1 through August 31st, plus two community associates which were not accounted for in the original data.)

[ii] May 2012 Draft Watershed Assessment. EPA. Appendix E. Tables 37 and 47.

EXHIBIT J

MEMORANDUM

To:	Mr. Bruce Jenkins	Date:	April 23, 2014
		File No.:	VA101-176/51-A.01
From:	Cathy Safadi, Jaime Cathcart	Cont. No.:	VA14-00529
Re:	Response to Final EPA BBWA Report: Leachate from Mine Facilities		

EXECUTIVE SUMMARY

KP reviewed the estimates and discussion of leachate flow for three hypothetical mine scenarios sited at the Pebble deposit, as presented in the EPA's Final Bristol Bay Watershed Assessment Report (BBWA) (EPA, 2014a). Our general conclusions are that:

1. None of the EPA's mine scenarios would be permittable under existing Alaskan state and US federal regulations. The EPA's reported losses of waste rock and tailings leachate to the downgradient streams are substantially greater than what would be permitted under current Alaska state and US federal regulatory requirements.
2. An operating mine that knowingly operates out of compliance with state and federal permits would be required to mitigate the situation and could be subject to fines and/or legal action.
3. The EPA ignored current conventional seepage (leachate) management design considerations, operational practices, and adaptive management strategies in their assessment of their hypothetical mine scenarios, yet recognize that such practices and strategies would be part of a properly designed, operated, and maintained mine.

1 – INTRODUCTION

The purpose of this memorandum is to provide Northern Dynasty Minerals Ltd. (NDM) with leachate-related discussion points for responding to the Final Bristol Bay Watershed Assessment Report (EPA, 2014a) submitted by the US Environmental Protection Agency (EPA). This memorandum focuses on the assessed groundwater leachate (seepage) from the hypothetical mine facilities in the EPA's report. The key conclusion of our review is that the reported losses of waste rock and tailings leachate are substantially greater than what would be expected with current regulatory requirements and conventional seepage design considerations and management practices, which include the ability to adapt to changing conditions as a mine develops.

2 – EPA REPORTED LEACHATE SUMMARY

2.1 WASTE ROCK LEACHATE

The EPA has considered three hypothetical mine scenarios sited at the Pebble deposit (Pebble 0.25, Pebble 2.0 and Pebble 6.5). For each of the mine scenarios, the EPA estimated the quantity of waste rock leachate expected to reach the streams. The basis of the estimates was as follows:

- Quantities were estimated for near the end of the mine life.
- All leachate produced from water flowing through waste rock placed above the open pit drawdown cone would report to the open pit and, therefore, would not discharge to the streams.
- 50% of the remaining waste rock leachate would be captured by recovery wells. This assumption results in 84% of Potential Acid Generating (PAG) leachate and 82% of the total waste rock leachate being captured by the pit and wells for the Pebble 2.0 scenario (EPA 2014a, Page 8-13). The remaining 16% and 18% of the respective leachate types were assumed to be released to downstream waters in an uncontrolled fashion.

Leachate quantities reaching the streams downgradient of the waste rock piles were reported by the EPA as flow returned (to the environment) as Non-Acid Generating (NAG) or PAG waste rock leachate in cubic meters per year (m^3/year) (EPA 2014a, Page 8-5 to 8-7). It is worth noting that the term "returned flow" is commonly used to describe leachate from a facility that is captured and returned to the facility, but the EPA instead use it to refer to leachate that is not captured and therefore "returned" to a stream.

The reported leachate quantities reaching stream gage locations SK100F and UT100D, which are situated downgradient of waste rock piles, are summarized in Table 1. Leachate flows of similar magnitude in a stream would be easily detected,

Table 1 EPA Scenario Waste Rock Leachate Quantities Flowing to Streams

Gage (Mine Scenario)	NAG Waste Rock Leachate[1]	PAG Waste Rock Leachate[1]
	m^3/year	
SK100F (Pebble 0.25)	557,000	0
UT100D (Pebble 0.25)	0	0
SK100F (Pebble 2.0)	1,140,000	216,000
UT100D (Pebble 2.0)	642,000	0
SK100F (Pebble 6.5)	1,278,000	1,032,000
UT100D (Pebble 6.5)	1,085,000	0

NOTES:
1. Values reported at SK100F are the summation of flow returned to the environment at SK100G and SK100F.

2.2 TSF LEACHATE

Similar to the waste rock leachate assessment discussed above, the EPA estimated the quantity of leachate from the Tailings Storage Facility (TSF) expected to reach the streams for each of the mine scenarios. The basis of the estimate was as follows:

- Quantities were estimated for near the end of the mine life.
- Seepage rates were assigned to the TSF embankments based on an estimate of the foundation conditions.
- Estimates of captured verses uncaptured TSF leachate were not explicitly defined in the EPA report. The EPA appears to have considered captured and uncaptured leachate based on a schematic showing both flow paths (EPA 2014a, Page 6-14). However the EPA reports total leakage amounts (EPA 2014a, Page 8-13) that are equal to the values reported as TSF leakage (uncaptured leachate returning to the environment) in Tables 8-5 to 8-7 (EPA 2014a, Pages 8-5 to 8-7).

Leachate quantities reaching the streams downgradient of the TSF, reported by the EPA as TSF leakage to downgradient streams in m^3/year (EPA 2014a, Page 8-5 to 8-7), are summarized in Table 2 for stream gage locations SK124A and NK119A.

Table 2 EPA Scenario TSF Leachate Quantities Flowing to Streams

Gage (Mine Scenario)	TSF Leakage m^3/year
SK124A (Pebble 0.25)	0
SK119A (Pebble 0.25)	0
NK119A (Pebble 0.25)	1,113,000
SK124A (Pebble 2.0)	2,000
SK119A (Pebble 2.0)	21,000
NK119A (Pebble 2.0)	2,305,000
SK124A (Pebble 6.5)	1,626,000
SK119A (Pebble 6.5)	2,930,000
NK119A (Pebble 6.5)	2,360,000

Leachate flows of similar magnitude in a stream would be easily detected.

2.3 ADDITIONAL DISCUSSION POINTS – REGULATORY CONTEXT

2.3.1 Permitting

Large mine projects in Alaska must comply with federal and state environmental laws and obtain federal, state and local government permits and approvals before construction and operation (EPA 2014a, Page 4-9). The Alaska Department of Natural Resources (ADNR) Office of Project Management and Permitting coordinates the permitting of large mine projects to ensure that projects are designed, operated and reclaimed in a manner consistent with public interest (EPA 2014a, Page 4-9). The predicted leachate flows in the EPA's assessment are higher than what would be acceptable under current regulatory standards; furthermore, greater seepage rate captures than assumed in the EPA's assessment can be achieved using current conventional seepage management systems. The EPA put forward a mine design with high estimated leachate losses from waste rock piles and a TSF that would not be permittable under current state and federal regulations.

2.3.2 Monitoring and Compliance

Along with the seepage control measures that would be put in place to capture leachate in a permitted mine, permits would also require continued monitoring and reporting of detected leachate. If leachate was detected, the mine operator would be required to implement adaptive management procedures to address the situation. Operations at the Fort Knox Mine in Alaska provide an example of the successful implementation of such adaptive management procedures following the detection of leachate (SRK, 2012). In 2006, Fairbanks Gold Mining, Inc. (FGMI) detected a surface seep from the downstream toe of the TSF embankment at the Fort Knox Mine. As per their permitting requirements, FGMI notified the relevant state agencies and immediately initiated an action plan that included the following (SRK 2012):

- *Capturing flow from the seep and returning the flow to the TSF impoundment*
- *Returning solution from existing surface water features immediately down-gradient of the seep to the TSF (in case they had been impacted by the seepage)*
- *Increasing the frequency of water quality monitoring (daily through May 2007, weekly from May to August 2007, and monthly from August 2007)*
- *Conducting an additional dam inspection by the Engineer of Record (Knight-Piésold)*
- *Placing additional groundwater interception wells*
- *Constructing a toe drain to capture shallow groundwater flow, and*
- *Placing six piezometers across the dam.*

Based on results from the ongoing monitoring of groundwater and surface water, the leachate has been contained within FGMI's seepage containment system. SRK (2012) reports that down-gradient groundwater and surface water sampling points outside of the containment perimeter continue to meet permit requirements. Any mine permitted in Bristol Bay would need to have similar monitoring and compliance systems in place. An operating mine that knowingly operates out of compliance with state and federal permits would be required to mitigate the situation and could be subject to fines and/or legal action.

2.3.3 Current Seepage Management Strategies

The EPA has ignored the benefits offered by conventional seepage management systems for both the waste rock piles (50% capture) and the TSF (no capture), which would be required to reduce seepage levels to the extent that downstream water quality would meet all permit requirements. Conventional seepage management systems may include:

- Seepage collection ponds down-gradient of the waste rock piles and TSF areas.
- Pumping wells to intercept and reduce potential leachate losses.
- Seepage cut-off walls.
- Partial or full lining of facilities.
- Design, installation, and operation of a groundwater monitoring program downgradient of the waste rock piles and TSF based on site specific mine design and groundwater conditions. During monitoring, trigger levels would be pre-determined to detect any potential releases of leachate to the environment that would result in corrective action.

Although some of these components were discussed in the EPA's assessment, a simplified assumption for the captured waste rock leachate of 100% recovery within the pit drawdown zone and 50% outside this zone were assumed with no actual calculation for the effectiveness of the seepage control measures. The amount of captured versus uncaptured TSF leachate was not clearly defined in the EPA's report; rather, the discussion focusses on all leachate collectively, and thereby implies no leachate capture.

The EPA indicates that mitigation measures beyond those considered in their assessment may be sufficient for improving and meeting water quality objectives for the Mine Scenario 0.25 (EPA 2014a, Page 8-54). Meeting water quality requirements for Mine Scenario 2.0 and 6.5 is only considered possible by the EPA if additional measures such as lining the waste rock piles, reconfiguring the piles or processing more of the waste rock are considered (EPA 2014a Page 8-54). Additionally, the EPA states that although the mine plan in their assessment is not adequate to meet regulatory requirements, incorporating additional seepage control measures can result in a design that meets downstream water quality standards. This statement is also supported by the following admissions by the EPA regarding the waste rock and TSF designs:

"If waste rock piles are designed properly with appropriate mitigation measures, monitored and maintained, release of contaminants is possible, but unlikely" (EPA, 2014a, Appendix I, Page 5).

"If a mine at the Pebble deposit goes forward, the design of the TSFs should include a more thorough flow analysis that would calculate the expected rate of flow and associated flow paths from the TSFs. If the calculated leakage rates were unsatisfactory from an environmental, operational, or economic perspective, the designer could incorporate other design elements (e.g., a liner) to reduce the expected leakage rate" (EPA, 2014b, Page 167).

3 – REFERENCES

SRK Consulting (SRK), 2012. Environmental Compliance and Management Systems Audit Fort Knox and True North Mines Report Submitted to State of Alaska Department of Environmental Conservation, State of Alaska Department of Natural Resources, State of Alaska Department of Fish and Game and Fairbanks Gold Mining, Inc.

United States Environmental Protection Agency (EPA), 2014a. An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska. EPA 910-R-14-001A, January 2014. Seattle, WA.

United States Environmental Protection Agency (EPA), 2014b. Response to Peer Review Comments on the May 2012 and April 2013 Drafts of an Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska.

Please do not hesitate to contact the undersigned if you have any questions or comments.

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
C. H. H. SAFADI
34954
April 23, 2014

Signed:

Cathy Safadi, P.Eng. – Senior Engineer

Reviewed:

Jaime Cathcart, Ph.D., P.Eng. – Specialist Hydrotechnical Engineer

Approved:

Ken Brouwer, P.Eng. – President

/icc

EXHIBIT K

Knight Piésold CONSULTING

www.knightpiesold.com

MEMORANDUM

To:	Mr. Bruce Jenkins, Mr. Steve Hodgson	Date:	April 23, 2014
		File No.:	VA101-176/51-A.01
From:	Dan Friedman, Jaime Cathcart	Cont. No.:	VA14-00530
Re:	Tailings dam failure - related technical support for NDM's response to final EPA BBWA		

EXECUTIVE SUMMARY

This memo is intended to support Northern Dynasty Minerals Ltd.'s response to the final Bristol Bay Watershed Assessment (BBWA) report (USEPA, 2014) with respect to tailings dam failure. The information presented here draws heavily on prior work, in particular that by Geosyntec Consultants in 2012 and 2013. A number of sections from the Geosyntec reports are cited and quoted in this memo, as they present some key points very clearly.

The key findings of this memo are as follows:

1. Probability of Dam Failure - It is incorrect to imply that any particular proposed or actual dam structure is more or less likely to fail based solely on the extrapolation of general dam failure statistics that may not be representative of the dam structure in question. The historical ICOLD data that are discussed by the USEPA in the BBWA report are not representative of a hypothetical tailings dam at the Pebble Project because they characterize past projects that were generally not subject to rigorous regulatory oversight or modern design, construction, and operating standards. Current state-of-the-practice standards were developed on the basis of lessons learned from the past. Rather than using historical performance to gage future performance, the integrity and stability of any dam structure should be ascertained by suitably qualified and competent professionals, whose assessment must take into consideration all relevant aspects of the specific site conditions and facility details. Furthermore, the accountability of an owner with a stated commitment to build and operate a facility in a socially, environmentally, and ethically responsible manner should be considered, as this can greatly enhance the success of a tailings dam project.
2. Regulatory Setting - The Pebble Project is located in a jurisdiction where the permitting requirements are thorough and the regulatory oversight is strong. The Alaska Dam Safety Program (ADSP), which is administered by the Alaska Department of Natural Resources (ADNR), was initially developed throughout the 1970s and 1980s to manage risks associated with dams. Based on Knight Piésold's extensive experience with tailings dam design, construction, and operation in many international jurisdictions, it is our opinion that the ADSP is a world-leading effort in dam safety management. The ADNR has jurisdiction over every dam in Alaska, including any that might be constructed as part of the Pebble Project.
3. State-of-the-Practice - By ignoring the state-of-the-practice, the BBWA report incorrectly concludes that the "worst case" scenario of dam failure is inevitable. It is wrong to expect that a tailings dam constructed and operated at the Pebble Project would fail to meet or exceed state-of-the-practice standards for engineering, construction, monitoring and operation. These standards are set forth by the regulatory requirements that will need to be met for design, construction and operation of a tailings dam at the Pebble Project.

The following sections provide supporting information to the key findings noted above. Section 1 addresses the BBWA's estimation of dam failure including slope failure, a discussion of the incorrect use by the EPA of the 2001 International Commission on Large Dams (ICOLD) data that are referenced heavily in the BBWA, and a section from Geosyntec on alternative evaluation of ICOLD case histories. Section 2 highlights modern engineering practices and how they would guide the design, permitting, construction, operation, maintenance, and regulatory oversight of safe dams in the Bristol Bay watershed. Section 3 provides examples of where modern engineering practices undermine the credibility of the BBWA report. Section 4 provides case studies of dam successes and failures as compiled by Geosyntec, and Section 5 discusses some of the flaws in the BBWA dam breach analysis.

1 – PROBABILITY OF DAM FAILURE AND MISAPPLICATION OF STATISTICS AND DATA

1.1 ESTIMATION OF DAM FAILURE PROBABILITY IN THE BBWA USING SILVA ET AL. (2008)

1.1.1 Slope Failure

The BBWA report concludes that the probability of slope failure for any given dam in the hypothetical mine scenarios presented in the assessment is between 1 in 1,000,000 years and 1 in 10,000 years (p. 9-10). This range of values, referred to as the "upper and lower bounds," is based on an application of the methodology for estimating probabilities of dam failure suggested by Silva et al. (2008).

The estimated "upper bound" of probability of failure was based on the assumption that the dams would be designed, constructed and operated as Category II projects (standard engineering practice). The "lower bound" was based on an assumption that the tailings dams in the hypothetical mine scenario would be designed, constructed and operated as Category I projects (state-of-the-practice engineering).

The tailings facilities at the Pebble Project would be planned and permitted, designed, constructed and operated to state-of-the-practice engineering standards, or better. Accordingly, the "upper bound" estimate of probability of failure of 1 in 10,000 years is irrelevant with respect to the Pebble Project and therefore misleading to the reader. Furthermore, the factor of safety against slope instability for dams designed for the Pebble Project would likely be higher than 1.5, leading to an estimated probability of failure of approximately 1 in 10,000,000 years. An appropriate application of the methodology proposed by Silva et al. (2008) results in probability of slope failure of between 1 in 1,000,000 years and 1 in 10,000,000 years.

1.1.2 Overall Probability of Failure

The USEPA goes on to state that "*slope failures only account for about 25% of all tailings dam failures with known causes. Thus, the probability of failure from all causes may be about four times higher than dam failures from slope instability alone (yielding an expected annual probability of failure between 0.0004 and 0.000004, or one tailings dam failure every 2,500 to 250,000 dam-years), although it is important to recognize that this small dataset may not be representative*."

We do not agree that this simplistic approach appropriately considers the complexity of the underlying causes of dam failures. The USEPA has simply used the Silva et al. (2008) methodology to estimate the probability of one failure mode (slope instability), which they then multiplied by four based on their determination that approximately 25% of all historical dam failures were caused by slope instability. They have therefore assumed that the probability of slope failure is similarly applicable to other modes of failure such as overtopping and seismic loading based on an interpretation of the historical dam failure data. Interpolating a relatively precise probability (*i.e.* 1 in 250,000) using an order-of-magnitude methodology implies an erroneous level of accuracy in the estimate.

The probability of other failure modes should be assessed independently to estimate an overall probability of failure for a given facility. These other modes of failure can be mitigated such that their probability of occurrence is near-zero, as is discussed herein.

For example, the tailings storage facilities at the Pebble Project would be designed to withstand flood flows from the Probable Maximum Flood (PMF). By definition, the precipitation event associated with the PMF is the "the theoretical maximum precipitation for a given duration under modern meteorological conditions" (WMO, 2009). The PMF is the flood based on the largest plausible deterministically derived storm event; as such, there is no probability associated with such a flood flow, but a suitable comparison would be a flood with a return period in excess of 1 in 1,000,000 years.

1.1.3 Conclusion

The "upper bound" estimate of probability of failure for a tailings dam of 1 in 2,500 years is not applicable to the Pebble Project because it does not consider the engineering standards to which the facility would be designed, constructed and operated.

The "lower bound" estimate of 1 in 250,000 years is based on an oversimplified application of the methodology presented by Silva et al. (2008) and does not appropriately consider the complexity of the underlying causes of dam failures. Furthermore, interpolating a relatively precise probability (*i.e.* 1 in 250,000) using an order-of-magnitude methodology implies an erroneous level of accuracy in the estimate.

It is our opinion that by implementing modern engineering practices at each step throughout the project life, the probability of a dam failure can be reduced to a negligible level. The probability of dam failure is estimated to be on the order of 1 in 1,000,000 to 1 in 10,000,000 using the methodology presented by Silva et al. (2008).

It must be clarified that the likelihood of a failure does not increase with each passing year. The probability of a failure (*e.g.* 1 in 1,000,000) is the same for each successive year that the structure is in existence; it is not comparable to "drawing numbers out of a hat" where the likelihood of an occurrence increases with each draw. Based on the information available today, the estimated probability of a dam failure would be the same in Year 10 of its life as it would be in Year 1,000.

1.2 DISCUSSION OF 2001 ICOLD DATA

The BBWA report presents an extensive discussion on a set of statistics based on the International Commission on Large Dams (ICOLD) Bulletin No. 121 (2001) that documents accidents and failures reported at 220 tailings dams between 1917 and 2000. The stated intent of the 2001 ICOLD report on these historical failures is "*to learn from them, not to condemn.*" As such, the ICOLD report was meant to provide a basis for establishing state-of-the-practice designs to ensure such failures did not occur in the future.

Guidelines for the design, construction and closure of safe tailings dams have been given by many publications, including previous ICOLD Bulletins throughout the 1980s and 1990s (ICOLD, 2001); however, it was evident that failures were still occurring. The 2001 ICOLD study was compiled largely in response to a number of failures in the 1990s and early 2000s that the authors felt could have been avoided. The 2001 report successfully aimed to clearly and fulsomely bring those recent and historical examples to the attention of tailings dam designers and operators by outlining the main causes of the reported failures in detail. It must be noted that many regulatory agencies, engineers, and mining companies were independently updating and revising their approach to tailings dam risk management during this key period in the 1990s and early 2000s, with the common goal of improving the state-of-the-practice such that future failures did not occur.

The period of time around the 2001 publication of ICOLD Bulletin No. 121 can be seen as a significant marker-point in the evolution of tailings dam design and management: modern tailings dam designs cannot be considered the same as earlier designs because of the lessons learned from the past and the incorporation of these lessons in modern designs. Yet, the USEPA utilizes the 2001 ICOLD data with consideration for neither the purpose of the report nor its impact on the features of tailings dam designs. To thus apply the pre-ICOLD data to Pebble represents a fundamental flaw in the analysis. In fact, there have been no reported catastrophic failures of centerline or downstream constructed, large rockfill tailings dams in developed nations since the publication of ICOLD Bulletin No. 121.

The ICOLD (2001) report states that "*many factors influence the behavior of tailings impoundments; accidents and other incidents are often the result of inadequate site investigation, design, construction, operation, or monitoring of the impoundment, or a combination of these. Every site and dam is unique so direct application from one to another is seldom possible. However, there are a number of common principles and the lessons learned from incidents at one dam can be applied in general terms to other situations.*" This reiterates the intent of the study, which is to help regulators, designers, and operators learn from past mistakes in order to avoid repeating them.

Several other publications have discussed the topic of historical tailings dam failure, including Davies (2000, 2002) and others. It is important to be clear on the intent of those studies; for example, Davies (2000) does not suggest that these statistics represent a probability of failure for any specific tailings dam, but rather indicates that "*there is the potential to essentially eliminate such events with an industry-wide commitment to correct design and stewardship practices*" (p. 11). The USEPA presents these studies in a manner that is inconsistent with their authors' intent and implies a much higher probability of failure for a tailings dam at the Pebble Project than is realistic.

It is incorrect to imply that any particular proposed or actual dam structure is more or less likely to fail based solely on the extrapolation of general dam failure statistics that may not be representative of the dam structure in question. The historical ICOLD data that are discussed by the USEPA in the BBWA report are not representative of a hypothetical tailings dam at the Pebble Project because they characterize past projects that were generally not subject to rigorous regulatory oversight or modern (post-ICOLD) design, construction, and operating standards. The lessons learned from the past have been used to develop the current state-of-the-practice standards. The integrity and stability of any dam structure should rather be ascertained by suitably qualified and competent professionals, whose assessment must take into consideration all relevant aspects of the specific site conditions and facility details. Finally, the success of a tailings dam project is enhanced by a strong, accountable owner with a stated commitment to build and operate a facility in a socially, environmentally, and ethically responsible manner (Haile and Brouwer, 2012).

The following statements are found in Appendix I of the BBWA and directly challenge the inappropriate probability of failure estimates presented in the Executive Summary and the body of the report that are simply based on the performance of tailings dams at historical mining operations (Geosyntec, 2013):

> *"The failure rate of tailings dams depends directly on the engineering methods used in design and the monitoring and inspection programs in the other mine-life stages."*
>
> *"Azam and Li (Azam and Li 2010) report that failures in all but Europe and Asia have decreased since 2000; this is attributed to improved engineering practices."*
>
> *"Data presented indicate that failures peaked to about 50 per decade in the 1960's through the 1980's and have dropped to about 20 per decade over the last 20 years, with the frequency of failure occurrences shifting to developing countries."*

1.3 ALTERNATIVE EVALUATION OF CASE HISTORIES (DIRECTLY FROM GEOSYNTEC 2012)

The following section is a direct quote from Geosytec's 2012 document.

> *Table 1 presents an alternate evaluation of the case histories in the ICOLD (2001) report. Beginning with the full database of 220 case histories, and given that the BBWA's assessment considers failure as a significant tailings release, all accidents, which did not result in release of tailings, are removed from the initial 220 cases, resulting in 136 failure case histories remaining. Additional review of the case histories allows further reductions for failure mechanisms that can be mitigated through modern design and construction practices as follows:*
>
> - *Case histories of failures on tailings dams with upstream construction are removed since this construction technique would not be used at the Pebble Project, resulting in 31 failure case histories remaining;*

- *Based on the previous and ongoing investigations for the Pebble Project, and accounting for the planned (Wardrop, 2011) significant foundation preparation prior to dam construction, foundation failure case histories are removed, resulting in 22 failure case histories remaining;*
- *Considering the hydrologic and hydraulic evaluations being performed, the planned significant freeboard as presented in the Wardrop (2011) report, and the erosion resistant rockfill, overtopping case histories are removed, resulting in 15 failure case histories remaining;*
- *Inadequate construction practices, primarily relating to poor compaction, accounted for several more case histories which can be removed relative to modern construction practices and comprehensive construction quality assurance as outlined in Alaska Dam Safety Guidelines (ADNR, 2005), resulting in 10 failure case histories remaining;*
- *Poor tailings management practices which resulted in beaches that were not properly maintained accounted for two more case histories which can be removed relative to mitigation from operations practices at a large-scale modern mine, resulting in 8 failure case histories remaining; and*
- *One failure case history is related to mine subsidence adjacent to the tailings dam, which is not applicable to Pebble, resulting in 7 failure case histories remaining.*
- *The seven remaining cases have significantly less documentation in the ICOLD (2001) report. However, it appears that causes of failure can generally be attributed to poor design resulting in one or more of the following: (a) use of insufficient factor of safety in dam design against slope failure; (b) lack of filter zone to control seepage; or (c) insufficient structural capacity in discharge piping leading to collapse of pipe.*

Table 1 ICOLD (2001) Case Histories and Mitigation Measures

Description	Number of Case Histories	Pebble Mitigation Measure
Total Studied Tailings Dams	220	N/A
After Removing Accidents	136	N/A
After Removing Upstream Construction Cases	31	Downstream / centerline construction
After Removing Foundation Failures	22	Comprehensive investigation Foundation preparation
After Removing Overtopping Failures	15	Sufficient freeboard
After Removing Improper Construction Failures	10	Good construction practices and Quality Assurance
After Removing Improper Operations Failures	8	Modern operations practices and tailings management
After Removing Mine Subsidence Failures	7	Distance
Remaining Cases	0	Various

It is our opinion that all of these failure mechanisms can be mitigated with proper investigation, design, construction, operations and maintenance, and oversight. Consistent with the intent of the ICOLD (2001) report, we consider that it is more appropriate to use these case histories "to learn from them, not to condemn."

Regulators, engineers, scientists, and owners learn from the mistakes of others in the past. While it is true that human nature sometimes leads to history repeating itself, it is also true that the rigorous application of engineering and science is intended to keep past failure outcomes from repeating. The probability of failure discussed in the BBWA, where the ICOLD data is used

as a basis for claiming the probability of failure, would be one tailings dam failure for every 2,000 mine years. This probability is not relevant to a modern mining project. An analysis that simply utilizes a retrospective failure rate to estimate future failures at a modern mining site significantly exaggerates the risks of a TSF failure, and therefore results in a biased assessment of future outcomes.

2 – HOW MODERN STATE-OF-THE-PRACTICE DESIGN REDUCES THE PROBABILITY OF DAM FAILURE

The authors of the BBWA report have generally not considered that modern mining practices will be used at the Pebble Project in the assessment (Geosyntec, 2013). Although reference is made to good international practice for engineering design, analysis, planning, permitting, monitoring, etc., these principles have largely been ignored. This is reflected in the fact that the "upper bound" probability of dam failure continues to be presented as 1 in 2,500 years based on the assumption that the design, construction, and operation of the facility would be to "standard engineering practice" and not "state-of-the-practice engineering". Any tailings dam considered at the Pebble Project would be developed using state-of-the-practice engineering, as discussed in the following sub-sections.

By implementing modern engineering practices at each step throughout the project life, the probability of a dam failure can be reduced to a negligible level. The specific areas of focus are discussed below and broadly follow the categories presented by Silva et al. (2008).

2.1 PLANNING AND PERMITTING

The Pebble Project is located in a jurisdiction where the permitting requirements are thorough and regulatory oversight is strong. For example, the Alaska Dam Safety Program (ADSP), which is administered by the Alaska Department of Natural Resources, was initially developed throughout the 1970s and 1980s to manage risks associated with dams. Based on Knight Piésold's extensive experience with tailings dam design, construction, and operation in many international jurisdictions, it is our opinion that the ADSP is a world-leading effort in dam safety management. The Program's mission statement is "*to protect life and property in Alaska through the effective collection, evaluation, understanding and sharing of the information necessary to identify, estimate and mitigate the risks created by dams*." The ADSP stipulates the requirements for many of the categories discussed below.

The ADSP was developed throughout the 1970s and 1980s following several dam failures in the United States of America during the 1970s. It is a pertinent example of a modern development in the state-of-the-practice that supports a significant reduction in the probability of a dam failure as compared to what the historical data would suggest.

Laws establishing the ADSP are found in the Alaska Statutes Title 46 Chapter 17, effective May 31, 1987. Regulations are in the Alaska Administrative Code Title 11, Chapter 93, Article 3, which were last amended October 2, 2004.

Another important modern development in dam safety is the implementation of Independent Tailings Dam Review Boards (ITRB) for major projects, such as Pebble. The significance of an ITRB is described by Dirk Van Zyl, Ph.D., P.E. in the Final Peer Review Report of the BBWA (2012):

The failure statistics given on p. 4-45 are based on tailings failure statistics over the last 50 years or so. Was there also a review of the operational histories, and therefore failures, of tailings impoundments designed and constructed in the last 10 to 15 years? It is recognized that one of the failures identified in Box 4-4 (Aurul S.A. Mine, Baie Mare, Romania) falls in this category. However, many of the failures included in the analyses are associated with older tailings facilities, especially those associated with large releases of tailings solids. A significant improvement in tailings management is the implementation of an Independent Tailings Dam Review Board (ITRB) for large mining projects (Morgenstern, 2010). An example of the activities of an ITRB is given in Minera Panamá (2012). Morgenstern (2010) provides a listing of tailings failures from 2001 and 2010 and comments that "in no case, to the knowledge of the Writer, was there

systematic third party review" of the failed facilities as would be the case when an ITRB is active. I expect that a tailings review board will also be used for the Pebble Mine and the behavior of a tailings management facility designed and operated under these conditions will be more representative of the potential failure likelihoods expected for such a facility. It is expected that this likelihood will be much lower than those used in the evaluations of the scenario in the EPA Assessment.

2.2 INVESTIGATION AND TESTING

Investigation and testing includes the collection of the applicable baseline data as they pertain to design, construction, and operation of a proposed dam. These investigations typically include, but are not limited to:

- Geotechnical investigations to assess foundation conditions
- Groundwater investigations to assess the potential interactions between the project and the environment
- Hydrometeorological investigations and monitoring to understand the impacts of climate on the project
- Geological and seismicity assessments

Substantial advances have been made in geotechnical engineering and soil mechanics since the formative work by Karl Terzaghi and others in the 1920s and 1930s. There has been ongoing development and evolution of the practice since then with major advances in the past 15 to 25 years, particularly post-ICOLD. For example, modern drilling and remote sensing capabilities allow for more rigorous and extensive testing of the foundation conditions for tailings dams than was possible in the past.

Additionally, the lessons learned from past tailings dam case histories, such as those presented by the ICOLD (2001), provide valuable insight to help focus site investigations and testing.

Site investigations and qualified interpretation of the information will reduce the probability of tailings dam failures that may result from an incorrect or incomplete understanding of the existing environment (*e.g.* geotechnical foundation conditions).

2.3 ANALYSES AND DOCUMENTATION

Analysis and documentation includes all the calculations, modeling, reporting, and drawing and technical specification preparation that is required to take a tailings dam from concept to construction.

Many of the advanced design and analysis tools that are now available to practitioners were either non-existent or in their infancy as recently as 25 years ago. These include finite element and finite difference models to assess dam stability and deformation characteristics under varied stresses, such as seismic loading. In fact, the first commercial application of the Fast Lagrangian Analysis of Continua (FLAC) code that is now commonly used for modeling deformation in tailings dams was in 1989. Advances in other models, such as three-dimensional groundwater modeling, allow designers to better understand and visualize the sometimes complex interactions between the environment and the proposed structure.

The lessons learned from past failures, through analyses such as ICOLD, provide important guidance for the engineers and scientists in developing site investigation and testing programs which are such an important component of modern tailings dam designs.

State-of-the-practice analysis and documentation during the design phases of a tailings dam project contribute to an inherent reduction in the probability of failure due to inadequate engineering. Potential failure modes are identified throughout the planning phases of a project and are mitigated for in the design.

2.4 CONSTRUCTION

Full-time supervision of construction activities by a qualified engineer and strong oversight by a regulatory system will ensure that the design is accurately executed in the field. Clear reporting of all construction activities must also be carried out for any major project.

Advances in surveying, field density and permeability measurement, and an increased commitment to quality control and quality assurance have been made in the past 15 to 25 years (post-COLD). Additionally, modern practice is informed by the lessons learned from past failures resulting from poor construction practices.

A substantial reduction in the probability of dam failure due to improper construction will result from the application of state-of-the-practice construction and quality assurance techniques.

2.5 OPERATING AND MONITORING

A complete monitoring program for a tailings dam would include measurement and reporting of tailings properties, water levels and pressures, climate, slope movements, and many other parameters. The performance of the dam would be continuously analysed to ensure that the parameters are consistent with those measured or assumed during the design and construction.

There have been significant recent advances in the technology that is available for monitoring dams. For example, continuous measurement of water level in the tailings facility and pore water pressures in the dam can be relayed to operators, owners, regulators, and engineers anywhere in the world. Alarms can be set to immediately alert operators, regulators, and even the public of unsafe conditions.

State-of-the-practice operating and monitoring systems would be used at the Pebble Project; these would substantially reduce the risk associated with unsafe conditions developing at a tailings dam without the knowledge of the operators. This would reduce the probability of failure modes that can be avoided or eliminated through proper monitoring.

2.6 CONCLUSION

By ignoring the state-of-the-practice, the BBWA report incorrectly concludes that the “worst case” scenario of dam failure is inevitable. It is wrong to expect that a tailings dam constructed and operated at the Pebble Project would fail to meet or exceed the standards of international good practice.

3 – DISCUSSION ON INTERNATIONAL GOOD PRACTICE

Modern engineering practice undermines the credibility of the inferences and conclusions of the BBWA report. For example when discussing the methodology for estimating probabilities of tailings dam failure:

> *“The advantage of this [USEPA’s chosen] approach is that it addresses current regulatory guidelines and engineering practices. The disadvantage is that we do not know whether standard practice or state-of-the practice dams will perform as expected, particularly given the potential dam heights and subarctic conditions in these scenarios.”* (USEPA, 2014, p. ES-23)

The proposed rockfill embankments are not new technology and have been proven to operate well under extreme conditions in many jurisdictions, including the State of Alaska, as discussed below in Section 4.2.

Again, in Section 14.6 of the BBWA it is stated that:

> *“The performance of modern technology in the construction of tailings dams is untested and unknown in the face of centuries of extreme events such as earthquakes and major storms.”* (USEPA, 2014, p. 14-7)

Numerous tailings dams, including those in Alaska, Chile, and Peru have recently withstood very large earthquakes. These natural processes and the consequent response of rockfill dams are well understood and can be estimated and designed for with reliability. Use of appropriate factors of safety combined with mitigation measures further lowers the inherent risk.

When discussing uncertainty in the design and operation of a modern mine in Alaska, the BBWA report states:

> *“Mines are complex systems requiring skilled engineering, design, and operation. The uncertainties facing mining and geotechnical engineers include unknown geological features,*

> *uncertain values of geological properties, limited knowledge of mechanisms and processes, and human error in design and construction. Models used to predict the behavior of engineered systems represent idealized processes and by necessity contain simplifications and approximations that potentially introduce errors."* (USEPA, 2014, p. ES-28)

The implication is that modern engineering is not up to the task of addressing these uncertainties and applying appropriate mitigation measures and factors of safety. It also implies that regulatory agencies, including the Federal Government and the State of Alaska are not well enough equipped to help manage the uncertainties inherent in a mining project. In practice, the areas of uncertainty, whether they are related to geological conditions or potential for human error, are addressed with factors of safety in design, contingency plans, and mitigation measures.

For example, the freeboard allowance at a tailings facility would allow enough storage for the design storm, wave run-up, wind setup, settlement of the dam, and additional "dry" freeboard. Each of these factors can be estimated, albeit with varying levels of accuracy, and appropriate factors of safety can be applied to address any uncertainty in the estimates. Applying rigorous analysis and appropriate factors of safety during design, combined with good monitoring practices during operation, can reduce the risk of overtopping of a dam to effectively zero.

Section 9.1.2 of the BBWA states that:

> *"Very few existing rockfill dams approach the size of the structures in our mine scenarios, and none of these large dams have failed" (USEPA, 2014, p. 9-9)*

Several tailings dams approach the size of the structures envisioned at Pebble and several exceed this in size. However, the BBWA statement is correct – the performance record for large, modern rockfill dams is very good and is expected to remain so.

4 – DAM FAILURE EXAMPLES FROM THE BBWA REPORT AND EXAMPLES OF RECENT SUCCESSES

4.1 RELEVANCE OF GIVEN FAILURE EXAMPLES (DIRECTLY FROM GEOSYNTEC, 2012 AND 2013)

The example case histories of TSF failures given in the BBWA report are either not relevant to Pebble, or their failure modes can be readily mitigated through proper design, construction, operations and management. The following section is a direct quote from Geosyntec's 2012 and 2013 documents including section numbering.

2.1.1Aznalcóllar Tailings Dam, Los Frailes Mine, Seville, Spain, 1998 (Foundation Failure)

> *The tailings dam at the Los Frailes Mine in Spain failed in 1998 primarily due to foundation instability of clays with low residual shear strength. As the clays lost strength, movement in these foundation materials was sufficient to transfer strain into the tailings, which subsequently liquefied and increased pressure on the dam, which itself then failed, resulting in the breach and loss of tailings (ICOLD, 2001; Wise, 2012).*
>
> *This foundation failure mode can be mitigated for the Pebble TSFs through proper investigation and foundation preparation. As stated in Wardrop (2011): "Embankment foundations will be prepared by removing all organics and unsuitable materials prior to controlled rockfill placement on competent overburden and/or bedrock foundations."*
>
> *Had these steps been taken at the Los Frailes mine, the 1998 failure would not have occurred.*

2.1.2 Stava, Italy, 1985 (Slope Instability Failure)

> *Two tailings dams failed at Stava, Italy in 1985. The dams were constructed with cycloned sand tailings which separate the coarse and finer fractions of tailings solids. The coarser fraction of tailings was sent to the face of the embankment for staged construction using the upstream method of construction. The two dams were built with overly steep embankments, and the toe of*

the upper dam was supported on the tailings of the lower impoundment. The stability of this configuration had a very low factor of safety against failure. On July 19th, 1985, the upper dam failed onto the lower dam, which overtopped and subsequently failed. While there were several causative factors, the upper dam in particular had such a low factor of safety that increases in water pressure behind the embankment were sufficient to trigger the failure (ICOLD, 2001; Stava, 1985 Foundation).

This slope instability failure mode can be mitigated for the Pebble TSFs through proper investigation and material characterization, and subsequent stability evaluation as input to design. The typical minimum factor of safety under static conditions (i.e. non-seismic) for a modern dam is 1.5, indicating that the forces resisting a slope failure exceed the forces driving failure (e.g. gravity) by 50%. While specific stability analyses have not been reviewed, for Pebble it is likely that seismic criteria will decide the final dam configuration, and static factors of safety will likely be higher than 1.5.

Had the Stava tailings dams been designed with appropriate factors of safety, the 1985 failure would not have occurred. As noted in the Wardrop (2011) report, the Pebble TSFs are likely to be built using earth and rockfill as opposed to tailings, and the downstream and centerline methods of construction will be employed instead of the upstream method used at Stava, which is more prone to failure (Wise, 2012).

2.1.3 Aurul S.A. Mine, Baia Mare, Romania, 2000 (Overtopping Failure)

The Aurul tailings dam failure in 2000 was a result of overtopping of the dams and subsequent breach and tailings release. Operation of the facility in sub-freezing temperatures resulted in significant ice and snow within the impoundment. Heavy rains and unusually warm temperatures in January 2000 resulted in ice and snowmelt along with precipitation, and the dam did not have sufficient freeboard to manage all of these sources at the same time. The dam embankment overtopped and eroded until a breach developed releasing significant tailings (ICOLD, 2001).

The overtopping failure mode would be mitigated for the Pebble TSFs primarily through design and operations with sufficient freeboard for extreme events. As stated in Wardrop (2011): "The TSF impoundment is sized to provide additional freeboard for complete containment of all runoff from the inflow design flood, for wave run-up protection, and for any post-seismic embankment settlement." In addition, the TSF embankment is to be constructed of erosion resistant rockfill, which is much less susceptible to failure from overtopping than the Aurul dam which was constructed of cycloned tailings.

Had these steps been taken at the Aurul S.A. mine, the 2000 failure would not have occurred.

2.1.4 Tennessee Valley Authority (TVA) Kingston Fossil Plant, Roane County, Tennessee, 2008 (Foundation Failure, Slope Instability Failure)

The TVA Kingston tailings dam failure in 2008 had many contributing factors, but can primarily be attributed to poor foundation conditions and slope instability. The dam was constructed by the upstream method and the impoundment held primarily hydraulic-filled ash. At the bottom of the impoundment there was a weak layer of slimes deposited near the beginning of the impoundment's life, likely in the 1950's. After the first three dam raisings, construction of the next upstream embankment was offset from the lower embankments, with the foundation for the new embankment sitting on top of the previously deposited ash tailings. The poor foundation conditions (historic slimes at depth and ash tailings below the offset embankment) and the offset geometry resulted in a low factor of safety against failure which, in combination with rapid filling rates, ultimately led to the failure in 2008 (AECOM, 2009).

These failure modes would be mitigated for the Pebble TSFs through proper investigation and material characterization, and subsequent stability evaluation as input to design. Additionally, proper foundation preparation and use of downstream and centerline construction are anticipated to result in adequate factors of safety.

Had the material properties (slimes and ash tailings) at the TVA Kingston tailings dam been understood and incorporated within the design, the 2008 failure would not have occurred.

4.1.1 Conclusion

The four failure examples stem from poor construction, poor operations, and/or poor design. Therefore, they are not relevant to a TSF of the caliber that will be proposed at Pebble. The only value that these case histories provide is as lessons learned from those failures and how the failure modes can be prevented.

4.2 *SUCCESSES IN ALASKA, CHILE, PERU (DIRECTLY FROM GEOSYNTEC, 2013)*

The following section is quoted directly from Geosyntac's 2013 document.

Performing a review of tailings dams that are successful is challenging, as the literature focuses more on problems than success stories. However, the literature does provide documentation related to several recent earthquakes that have subjected modern tailings dams to significant stresses. The following four case histories of large active tailings dams, while certainly not an exhaustive review, do indicate that analogies to seismic risks at the Pebble site exist showing that applying modern design, construction, and operations and management practices can result in successful performance under significant stress with no, or minimal, damage reported.

- *Tranque Ovejeria and Tortolas, Chile*

  These tailings dams are at the same facility and constructed by placing cycloned sand tailings by the downstream method. These dams are located approximately 230 miles north of the epicenter of the February 2010 Magnitude 8.8 Chilean earthquake. No damage was observed at the dams (GEER, 2010).

- *Tranque Caren, Chile*

  This tailings dam was constructed using the downstream method. It is located 150 miles north of the epicenter of the February 2010 Magnitude 8.8 Chilean earthquake. Dam raising was in progress at the time of the February earthquake. After the earthquake, some minor (e.g. millimeter wide) transverse cracking was visible near each abutment (GEER, 2010).

- *Antamina Copper-Zinc Mine Tailings Dam, Peru*

  Construction began in 2001 and is currently undergoing its fourth dam raising to approximately 705 ft tall. It is one of the tallest in the world and has been constructed completely by the downstream method. It is located 275 miles from the epicenter of the August 2007 Magnitude 8.0 Peru earthquake. No damage was observed at the dam (Chanjaroen, 2007).

- *Fort Knox Gold Mine Tailings Dam, Alaska*

  Construction began in 1995 and is planned to reach ultimate height of approximately 360 ft in 2013. It is located 100 miles from the epicenter of the November 2002 Magnitude 7.9 Denali earthquake. No damage was observed at the dam (ADNR, 2007).

4.3 CONCLUSIONS

The probability of dam failure can effectively be reduced to near-zero by applying international good practice at each stage of the project. Appropriate factors of safety and mitigation measures would be used to address areas where uncertainty may be a contributing factor to the risk of dam failure.

The advancement of modern engineering practice, regulatory programs, and technology over the past 15 to 20 years, particularly post-ICOLD, has contributed to a reduction in the risk inherent with tailings dam design, construction, and operation. These advancements will be used together with the lessons learned from past failures to ensure that the probability of a tailings dam failure at the Pebble Project is negligible.

5 – FLAWS IN THE DAM BREACH ANALYSIS

The BBWA report devotes considerable resources to assessing in great depth, detail, and with questionable accuracy, the hypothetical effects of a dam breach event that is estimated to have an extremely low probability of occurrence on the order of 1 in 1,000,000 years. The rationale behind expending a large amount of effort on developing this analysis appears to be based on the flawed conclusion that a failure rate on the order of 1 in 2,000 years is plausible for tailings dams at the Pebble Project.

However, the assessment comes to an obvious conclusion: a tailings dam failure under the worst imaginable scenario could have substantial negative effects on the environment if it were allowed to occur.

The conclusion that the potential environmental effects of a hypothetical one-in-a-million event would be substantial could have been arrived at with much less effort through the application of judgement, experience, and common sense.

The independent expert peer reviewers commissioned by the USEPA and subsequent third parties have pointed out substantive technical flaws with the dam breach analysis presented in the BBWA report. However, this is considered rather unimportant given that a defensible estimated probability of a tailings dam failure is extremely low.

5.1 SPECIFIC DEFICIENCIES IN THE DAM BREACH ANALYSIS (GEOSYNTEC, 2013)

The following sections are cited from Geosyntec's 2013 document, Table 1, Sections 2.4.1-2.4.5; note that the original formatting has been modified.

- Digital Elevation Model Accuracy

  The analysis in the 2012 Assessment relies on a very coarse 30 metre digital elevation model (DEM) to develop channel bathymetry. The coarse nature of the 30 meter DEM does not account for channel complexity in the floodplain where side channels or wider braided channels are only activated during floods and are available for sediment deposition. Off channel wetlands and watercourses are also missed. The lack of channel complexity and channel morphology oversimplifies the channel roughness and leads to river channels characterized as too "clean" and "smooth." As a result, the coarse model very likely over predicts flows, velocities and sediment transport relative to what would be expected in reality (Crosby, 2006).

- Manning's Friction Coefficient

  The 2013 BBWA report states "*When applied to tailings dam failure events, it is appropriate to increase channel roughness coefficients to better emulate flow characteristics of concentrated sediment flows. Manning's n = 0.2 for the channel and 0.6 for the floodplain were selected*." (p. 9-21)

  The BBWA report, however, does not provide any analysis or justification for these numbers. In addition, the report does not indicate if multiple model runs were completed to evaluate the sensitivity of the model results to Manning's n.

- Lateral Extents of the HEC-RAS Model

  The lateral extents of the cross-sections in the HEC-RAS model were likely insufficient, resulting in increased flow depth and higher velocities.

  More importantly, the extraordinary change between the 2012 and 2013 analysis is evidence that the dam breach analysis should not be relied upon. One set of assumptions was made in 2012, and

a very different set of assumptions was made in 2013, with very different results. Given the limitations of the HEC-RAS model, the coarse nature of the inputs to the model, and the sensitivity of the model to changes in parameters, it is clear that neither result is a reasonable representation of what would actually happen in the very unlikely event of a dam breach.

- Tailings Run-out Analysis

  The mine tailings dam breach run-out scenarios in the BBWA report are modeled to a distance of only 30 km and the analysis then utilizes a tailings run-out regression equation to calculate total mine tailings travel distances beyond the last segment of the model. Switching from a simplistic sediment transport approach to an even more simplistic regression equation once the mine tailings reach the confluence of the North Fork Koktuli and South Fork Koktuli Rivers only adds to the uncertainty in the estimates of the distance of sediment transport**.**

- Sedimentation and Deposition of Tailings

  The BBWA report assumes that deposition occurs at high velocities, extending out across the width of the inundation wave at the peak of the flood wave. However, for the most part the evaluation disconnects sediment depth from the dam breach analysis. Sediment thicknesses are almost entirely controlled by assumptions:
  - Sediment "wedge" up to 45 m thick near the dam, extending at a slope of 15:1 (H:V) (p. 9-19); and
  - Sediment thickness at a constant 0.3 m thick beyond the toe of the "wedge."

  This approach raises the following question: What is the purpose of the dam breach analysis?

6 – REFERENCES

ADNR (Alaska Department of Natural Resources). 2005. Guidelines for Cooperation with the Alaska Dam Safety Program. Dam Safety and Construction Unit, Water Resources Section, Division of Mining, Land, and Waters. 230 pp.

ADNR (Alaska Department of Natural Resources). 2007. State Agency Response to Public Comments on Draft Authorizations for the Fort Knox Mine Heap Leach Project. July 3, 2007.

AECOM. 2009. Root Cause Analysis of TVA Kingston Dredge Pond Failure on December 22, 2008.

Chanjaroen. C. 2007. "BHP Says No Impact on Antamina Copper Mine from Peru Earthquake." August 16, 2007. http://www.bloomberg.com/

Crosby, D. A. 2006. The Effects of DEM Resolution on the Computation of Hydrologically Significant Topographic Attributes. Master's Thesis. University of South Florida. Tampa, Florida.

Davies, MP, Lighthall, PC, Rice, S, and Martin, TE. 2002. Design of Tailings Dams and Impoundments, Tailings and Mine Waste Practices SME, Phoenix, 2002.

Davies, MP, Martin, TE, Lighthall, P. 2000. Mine Tailings Dams: When Things Go Wrong. Tailings Dams. Association of State Dam Safety Officials, US Committee on Large Dams, Las Vegas, Nevada. Pp. 261-273.

International Commission on Large Dams (ICOLD). 1995, Tailings Dams and Seismicity, Bulletin Number 98.

International Commission on Large Dams (ICOLD). 2001. Tailings Dams Risk of Dangerous Occurrences, Lessons Learnt from Practical Experiences. Bulletin Number 121.

GEER. 2010. Geo-Engineering Reconnaissance of the February 27, 2010 Maule, Chile Earthquake. Version 2: May 25, 2010. By Geo-Engineering Extreme Events Reconnaissance (GEER) team.

Geosyntec. 2013. Assessment of USEPA Response to Geosyntec's Comments on the Bristol Bay Watershed Assessment. Prepared by Geosyntec Consultants, 22 May 2013.

Geosyntec. 2012. Technical Review of May 2012 Draft Report EPA 910-R-12-004a, An Assessment of Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska. Prepared by Geosyntec Consultants, 18 July 2012.

Haile, J.P., Brouwer, K.J. 2012. Mitigating Risk in the Design and Construction of Tailings Dams in Alaska.

F. Silva, T.W. Lambe, W.A. Marr. December 2008. Probability and Risk of Slope Failure. Journal of Geotechnical and Geoenvironmental Engineering, ASCE.

Stava 1985 Foundation. http://www.stava1985.it/stava1985

U.S. Environmental Protection Agency (USEPA). 2014. An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska: Executive Summary. EPA 910-R-14-001ES. Seattle, Washington.

U.S. Environmental Protection Agency (USEPA). 2014. An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska: Volume 1 – Main Report. EPA 910-R-14-001A. Seattle, Washington.

U.S. Environmental Protection Agency (USEPA). 2014. An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska: Volume 2 – Appendices A-D. EPA 910-R-14-001B. Seattle, Washington.

U.S. Environmental Protection Agency (USEPA). 2014. An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska: Volume 3 – Appendices E-J. EPA 910-R-14-001C. Seattle, Washington.

Versar. 2012. Final Peer Review Report – External Peer Review of EPA's Draft Document – An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska. Prepared for the U.S. Environmental Protection Agency, September 17, 2012.

Wardrop. 2011. Preliminary Assessment of the Pebble Project, Southwest Alaska. Prepared for Northern Dynasty Minerals Ltd., February 15, Prepared by Wardrop (A Tetra Tech Company), Vancouver, BC. [Note: This report is referenced as Ghaffari et al. 2011. in the BBWA]

Wise Uranium Project (Wise). 2012. http://www.wise-uranium.org/

World Meteorological Organization (WMO), 2009. Manual on the Estimation of the Probable Maximum Precipitation (PMP), WMO-No. 1045, 2009.

Signed: _____
FOR Daniel Friedman, P.E. – Senior Engineer

PROFESSIONAL ENGINEER
J. G. CATHCART
BRITISH COLUMBIA

Reviewed: _____ April 23, 2014
Jaime Cathcart, Ph.D., P.Eng. – Specialist Hydrotechnical Engineer

Approved: _____
FOR Ken Brouwer, P.Eng. – President